

UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
ASHEVILLE DIVISION

STATE OF NORTH CAROLINA)
ex rel. Roy Cooper, Attorney)
General,)
)
 Plaintiff,) No. 1:06-CV-20
)
 vs.) **VOLUME 3A**
)
TENNESSEE VALLEY AUTHORITY,) [Page 503-649]
)
 Defendant.)
)

TRANSCRIPT OF TRIAL PROCEEDINGS
BEFORE THE HONORABLE LACY H. THORNBURG
UNITED STATES DISTRICT COURT JUDGE
JULY 16, 2008

APPEARANCES:

On Behalf of the Plaintiff:

JAMES C. GULICK, Senior Deputy Attorney General
MARC BERNSTEIN, Special Deputy Attorney General
North Carolina Department of Justice
114 West Edenton Street
Raleigh, North Carolina

MICHAEL D. GOODSTEIN, Esquire
ANNE E. LYNCH, Esquire
Resolution Law Group, P.C.
5335 Wisconsin Avenue NW, Suite 360
Washington, DC

On Behalf of the Defendant:

FRANK H. LANCASTER, Senior Attorney
HARRIET A. COOPER, Assistant General Counsel
THOMAS F. FINE, Assistant General Counsel
MARIA V. GILLEN, Assistant General Counsel
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee

Karen H. Miller, RMR-CRR, Official Court Reporter

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2 **THE COURT:** All right. I believe we're ready to
3 proceed with cross-examination.

4 **MR. LANCASTER:** Thank you, Your Honor. If I might
5 suggest that the witness and the Court get TVA book 12,
6 exhibit book 12 that I may be referring to, and also
7 plaintiff's exhibit book 1.

8 **CROSS EXAMINATION**

9 **BY MR. LANCASTER:**

10 **Q.** Good morning, Dr. Staudt.

11 **A.** Good morning.

12 **Q.** Isn't it true about half the electricity generated in
13 the United States is from coal-fired power plants?

14 **A.** That's about right, yes.

15 **Q.** And for this reason, coal-fired power plants are an
16 important part of America's energy infrastructure, correct?

17 **A.** That would be correct, yes.

18 **Q.** There are, in fact, about 1200 coal-fired electricity
19 generating units in the United States, correct?

20 **A.** On that order, yes.

21 **Q.** All of these coal-fired power plants in the United
22 States emit some amount of sulfur dioxide, correct?

23 **A.** That's correct.

24 **Q.** And as a shorthand, sulfur dioxide is often referred to
25 by its chemical formula, SO₂?

1 A. That is correct, yes.

2 Q. SO₂ emissions are controlled either by limiting the
3 amount of sulfur in the coal or by installing scrubbers that
4 remove SO₂ from the exhaust gas, correct?

5 A. That is correct, yes.

6 Q. I'd like to talk about scrubbers first. They are also
7 known as FGD; is that correct?

8 A. That is correct, yes.

9 Q. And that stands for flue gas desulfurization.

10 A. That is correct.

11 Q. And flue is f-l-u-e.

12 A. Flue, that's right.

13 Q. Most of the 1200 coal-fire electricity generating units
14 in the states were built without scrubbers for SO₂ reduction;
15 correct?

16 A. That is correct.

17 Q. Now, after a power plant has already been built without
18 a scrubber, it can be retrofitted with a scrubber, correct?

19 A. That is correct.

20 Q. But building a scrubber is a big project, isn't it?

21 A. Yes, it is.

22 Q. And a scrubber can cost hundreds of millions of dollars
23 to design and build, can't it?

24 A. Yes, it can, but this is part of the routine cost of
25 operating a power plant. It's -- lot's of -- Duke and

1 Progress are spending that kind of money to install these
2 scrubbers, and other utilities throughout the country,
3 Southern Company and others, are spending this order of money
4 to install these scrubbers, compared to the -- they wouldn't
5 be doing it, particularly, the investor-owned utilities
6 certainly wouldn't be doing it, if they didn't see it as
7 providing a -- being a good investment.

8 Q. I apologize, Dr. Staudt. I must not have phrased my
9 question very well. I didn't intend to ask you about why
10 other utilities would do things. I simply meant to confirm
11 whether or not scrubbers can cost hundreds of millions of
12 dollars to design and build.

13 A. That is correct, yes.

14 Q. It is more difficult to retrofit an existing plant with
15 a scrubber than it is to put a scrubber on a new unit as it
16 is being constructed, correct?

17 A. That is correct.

18 Q. But TVA has, in fact, retrofitted seven coal-fired units
19 on its system with scrubbers, correct?

20 A. That is correct, yes.

21 Q. All three units at TVA's Paradise plant have been
22 retrofitted with scrubbers; is that correct?

23 A. That is correct.

24 Q. And both units at TVA's Cumberland plant in Tennessee
25 have scrubbers; is that correct?

1 A. That is correct, yes.

2 Q. And units 7 and 8 at TVA's Widows Creek plant in Alabama
3 have scrubbers; is that correct?

4 A. Yes, they do.

5 MR. LANCASTER: Your Honor, may I have permission
6 to put one of Dr. Staudt's exhibits back on the stand to ask
7 him a question about it?

8 THE COURT: Sure.

9 BY MR. LANCASTER:

10 Q. Dr. Staudt, you just indicated that Widows Creek plant,
11 TVA's Widows Creek in Alabama, has scrubbers on two units; is
12 that correct?

13 A. That is correct, yes.

14 Q. And those are units 7 and 8?

15 A. That is right, yes.

16 Q. And this is a photograph of the stacks from unit 7 and 8
17 at Widows Creek?

18 A. That is correct.

19 Q. Which one is 7?

20 A. 7 is the one with the white --

21 Q. The white puffy smoke?

22 A. Yes.

23 Q. Which you indicated yesterday was water vapor?

24 A. Yes.

25 Q. And that's the one on the left?

1 A. That's correct, yes.

2 Q. And unit 8 is the one on the right?

3 A. On the right.

4 Q. And I understood you yesterday to indicate that the one
5 on the right, unit 8, you believed was operating with its
6 scrubber bypassed; is that correct?

7 A. Yes. And that's what we were told when we visited the
8 site, yes.

9 Q. I couldn't hear you, sir.

10 A. Yes. That is what we were told when we visited the
11 site.

12 Q. You were told that the scrubber was bypassed?

13 A. That they were not operating the scrubber, that's true.
14 The scrubber is what is used for particulate removal at
15 that plant.

16 Q. And who told you that the scrubber was being bypassed?

17 A. I don't remember. The person from the plant. But
18 that's what I recall being told.

19 The scrubber was not in operation.

20 Q. All right. Did you observe any physical equipment that
21 would permit the bypass of the scrubber at Widows Creek unit
22 8?

23 A. No, I don't recall. I don't recall looking for bypasses
24 at Widows Creek No. 8.

25 Q. Whether you looked or not, did you actually observe any

1 equipment at Widows Creek unit 8 that would physically permit
2 the bypass of the scrubber?

3 A. I don't recall that.

4 Q. Thank you.

5 So TVA's system has seven scrubbers in operation now; is
6 that correct?

7 A. That is correct.

8 Q. Seven units are scrubbed?

9 A. Seven units are scrubbed.

10 Q. You mentioned yesterday that you have a friend at
11 Southern Company who talked to you about Southern Company's
12 program; is that correct?

13 A. Yes, he did.

14 Q. Who is he or she?

15 A. Larry Monroe. He and I went to MIT together, at the
16 combustion research facility at MIT together.

17 Q. Did I understand you correctly to say that Larry Monroe
18 said that Southern Company had zero scrubbers?

19 A. No. He said Southern Company has gone from being the
20 least-scrubbed utility to being the most-scrubbed utility in
21 the last few years. That's what he said.

22 Q. Oh. I understood you to say that they had zero
23 scrubbers.

24 A. I don't recall me saying that they had zero scrubbers.

25 Q. Now, in the United States --

1 **A.** Because they actually do have scrubbers. They have had
2 scrubbers at Yates for a while.

3 **Q.** Now, in the United States, about a third of the
4 coal-fired generating capacity is scrubbed. Isn't that
5 correct?

6 **A.** Well, that was probably true at one point. It's higher
7 now because people have been installing scrubbers. You're
8 looking at a moving target, as I testified during my
9 deposition. At one point it was probably about a third, but
10 because, as a result of people installing scrubbers over the
11 last few years, it's certainly a higher number than that now.

12 By 2010, EPA's estimated it's going to be about
13 two-thirds of the capacity in the U.S. will be scrubbed. And
14 you've got North Carolina right now, half of the capacity in
15 North Carolina, of Duke and Progress capacity, is scrubbed.
16 So one-third was true at one point in time in the past. It's
17 probably not -- it's a low number today.

18 **Q.** If you would turn to Exhibit 239, which is a copy of
19 your deposition.

20 **A.** Yes.

21 **Q.** If you would turn to page 65. And I apologize. This is
22 the type of transcript that has four pages on one page. This
23 is the only version we had.

24 **A.** I'm there.

25 **Q.** All right. I was asking you questions in your

1 deposition, at line 10 on page 65:

2 "If most of the roughly 1200 coal-fired units in the
3 United States were built without scrubbers, how many of them
4 have been retrofitted with scrubbers?"

5 And you answered: "Well, of the roughly 300,000
6 megawatts of coal-fired generation in the United States, as
7 of a couple of years ago, as of a short time ago, roughly
8 about one-third of them had some kind of FGD technology."

9 Do you recall giving that testimony?

10 A. Yes. And that was a correct statement as of a period of
11 time ago, roughly.

12 Q. And you gave your deposition on May 16th, 2007?

13 A. That's correct.

14 Q. And on May 16th, 2007, as of a short time ago from that
15 date, roughly about one-third of the coal-fired generation in
16 the United States had some kind of FGD technology, which is a
17 scrubber, correct?

18 A. Yes. But I'd like to draw your attention to line 23.
19 It says: "In the last few years there has been a lot of
20 activity to retrofit quite a few more."

21 Q. And you have not calculated --

22 A. And in another few years there will be -- excuse me.
23 Let me -- I'd like to finish my answer, please.

24 And within a few years, there may be close to two-thirds
25 of that 300,000 megawatts will be retrofitted.

1 So I made it very clear that at one point it was about
2 one-third. We're in the process of having a lot of plants
3 retrofitted with scrubbers and, as I say here, we're getting
4 close to having two-thirds of the plants.

5 So what you're talking about is -- you can only look at
6 things at a point in time, and things are moving. Scrubbers
7 are being stalled, and I was -- that's what I said in my
8 deposition, and that's what I'm saying here today.

9 **Q.** Pardon me. You said within a few years there may be
10 close to two-thirds; is that correct?

11 **A.** That is correct.

12 **Q.** And have you calculated whether or not -- have you
13 calculated any number above one-third of scrubber capacity
14 that has been reached since May 16th, 2007? Have you made
15 that calculation?

16 **A.** Yes. I keep track of that data in the course of my
17 business, my regular business.

18 **Q.** And today, what is the number?

19 **A.** The number, the number is close to a half. It depends
20 upon which units are on line, you know. Right now, we're in
21 the midst of putting a lot of units on line. At this point
22 in time, we're in the midst of putting a lot of scrubbers on
23 line, so you're looking at a quickly moving target.

24 So even in just the last few months, we've seen a lot
25 happen just in the state of North Carolina. So the number

1 changes month by month.

2 Q. I understand that. And if I understand your testimony,
3 you believe now the number may have grown to roughly one-half
4 instead of one-third; is that correct?

5 A. Yes.

6 Q. And if I understood your testimony from yesterday, the
7 prospects for that number continuing to grow have diminished
8 as a result of the decision State of North Carolina won in
9 the D.C. Circuit last Friday vacating the Clean Air
10 Interstate Rule; is that correct?

11 MR. GOODSTEIN: Objection, Your Honor. It's a
12 mischaracterization of the State's position in that
13 litigation.

14 THE COURT: I'll let the witness answer the
15 question.

16 THE WITNESS: Could you repeat the question,
17 please?

18 Could you repeat the question, please?

19 BY MR. LANCASTER:

20 Q. Oh. Is it your testimony that as a result of the
21 vacation of the CAIR rule, the Clean Air Interstate Rule,
22 C-A-I-R, that the increase in scrubber capacity is likely to
23 slow down its pace.

24 A. I think it will affect -- for the projects projected
25 before 2010, will certainly -- I think it will have a less of

1 an impact than the projects after that, because the projects
2 that are farther out are a lot easier to cancel or postpone.

3 So it will have some impact, I think. In terms of the
4 2010 number, I don't think it will have a big impact, but the
5 numbers after that, I think it will have a greater impact.

6 Q. So the scrubbers that are slated to come on line by 2010
7 ought to come on line as planned.

8 A. I would hope so, but, as I said, there is some chance
9 some might get postponed.

10 Q. But there's a likelihood that the scrubbers out through
11 2010 will in fact continue to role on line.

12 A. It's hard to say. I think the closer the scrubber is to
13 completion, the more likely it is that it will be completed.
14 The farther away it is from completion, the more likely it is
15 that it may be postponed or delayed or canceled.

16 Q. Okay. Thank you.

17 Besides putting a scrubber on a coal-fired power unit,
18 changing to lower sulfur coal is a frequently used approach
19 for reducing sulfur dioxide emissions, correct?

20 A. Yes, that's correct.

21 Q. And TVA currently limits its SO₂ emissions at most of
22 its plants by limiting the sulfur content in the fuel,
23 correct?

24 A. Yes. In most of its plants, they -- well, they use
25 fuels of particular sulfur contents, and that's one way to

1 control your SO₂ emissions.

2 Q. But it's a correct statement to say that TVA currently
3 limits its SO₂ emissions at most of its plant by limiting the
4 sulfur content of the fuel.

5 A. Well, I can't speak whether or not they actually have
6 a practice of limiting, you know, what they state in their
7 coal contracts in terms of what the sulfur content may be
8 limited to, but that may be a practice.

9 TVA buys coals with -- and they have sulfur contents
10 and -- but they may, they may or may not have specific
11 limitations in their contracts.

12 Q. If you could turn to Exhibit 241 in defendant's book 12.
13 Is that a copy of your expert report?

14 A. Yes, it is.

15 Q. If you could turn to page 16, please.

16 A. I'm there.

17 Q. And on page 16, there is a Figure 13. Do you see that?

18 A. Yes, I do.

19 Q. And then the paragraph above the Figure 13, would you
20 please read the second sentence of that paragraph?

21 A. "TVA currently limits its SO₂ emissions at most of the
22 TVA plants by limiting the sulfur content of the fuel at the
23 plant, which restricts TVA's fuel options."

24 Q. So is it a correct statement to say that TVA currently
25 limits its SO₂ emissions at most of the TVA plants by

1 limiting the sulfur content of the fuel at the plant?

2 **A.** It's true. It's the way to manage your SO₂ emissions.

3 I was only making the point earlier, when you say
4 specifically limitation, I don't know what you have in your
5 fuel contracts.

6 **Q.** You wrote that sentence, didn't you?

7 **A.** Yes, I did, and it was the intent of saying that that's
8 the way you manage your SO₂ emissions.

9 **Q.** Now, an example of low sulfur coal is coal from out west
10 called Powder River Basin coal, or PRB coal, for short. Is
11 that correct?

12 **A.** That's correct.

13 **Q.** And that's in all caps, "PRB"?

14 **A.** That's correct.

15 **Q.** And TVA's Gallatin plant near Nashville, Tennessee,
16 burns this low-sulfur PRB coal, correct?

17 **A.** That's my understanding, yes.

18 **Q.** Are you aware that TVA's Allen plant in Memphis,
19 Tennessee, also burns low-sulfur PRB coal and last year had a
20 sulfur dioxide emission rate under .5 pounds per million
21 British Thermal Units?

22 **A.** I did not look at that, but if TVA is reducing its
23 sulfur SO₂ emissions, that's a good thing. As I have said,
24 it shows that TVA is capable of getting access to this coal
25 and is able to reduce its SO₂ emissions.

1 Q. And is an emission rate of .85 pounds per million
2 British Thermal Units, does that constitute low-sulfur coal?

3 A. It's .85 pounds per British Thermal Unit coal. It's
4 all -- I don't like to get caught into the game of going
5 what's low sulfur and what's high sulfur. It's a .85 pound
6 per million BTU coal. If that's what it is, that's what it
7 is.

8 Q. I'd like to draw your attention now to TVA Exhibit 264
9 in book 12.

10 Is TVA Exhibit 264 an article you wrote entitled
11 "Optimizing Compliance Costs for Coal-fired Electric
12 Generating Facilities in a Multi-Pollutant Coal Environment"?

13 A. Yes, it is.

14 Q. And if you would turn to page 7 of this article that you
15 authored.

16 And in Table 2 at the bottom of page 7 is a column
17 headed "SO₂" and a row labeled "Current Emissions."

18 Do you see that?

19 A. Yes. Yes, I do see that.

20 Q. And could you read that for me, please?

21 A. Yes. Yes. It says .85 pound per million BTU low-sulfur
22 coal.

23 Q. And if I was remembering my high school chemistry
24 correctly, that "S" means sulfur?

25 A. That, indeed, it does.

1 Q. So in this article you wrote and published, you
2 described 0.85 pounds per million British unit coal as
3 low-sulfur coal; is that correct?

4 A. For the purpose of this particular article, yes, I did.
5 In general, I don't use -- I wouldn't use it for the
6 purpose of just comparing various coals.

7 Q. And the purposes of this paper were to publish it in
8 proceedings before the American Society of Mechanical
9 Engineers Conference; is that correct?

10 A. Yes, it was.

11 Q. And in operating, not in the courtroom, but in the
12 American Society of Mechanical Engineer's Conference, you
13 describe point .85 pound coal as low-sulfur coal, correct?

14 A. Well, it says what it -- you know, the document speaks
15 for itself, so it says what it says.

16 Q. Now I would ask that you turn to plaintiff's exhibit
17 book number 1, Exhibit 10.

18 Plaintiff's Exhibit 10 was admitted into evidence
19 earlier in this trial as the 2008 North Carolina Clean
20 Smokestacks Act report. I would like to turn your attention
21 to Attachment A, page 12 of 15, which we will put up on the
22 monitor.

23 And does this document indicate the plans for Duke
24 Energy's operations during 2009 and 2013 concerning their
25 sulfur dioxide emission rates?

1 **A.** Excuse me. Can you tell me what page this is on? I'm
2 having a problem finding it.

3 **Q.** It's Attachment A, page 12 of 15, and it's on the screen
4 at this point.

5 **A.** Yeah, but I'd like to see the whole document rather than
6 look at a snippet of it.

7 **Q.** Certainly.

8 **A.** Okay.

9 **Q.** Does it indicate that during the year 2009, Duke Energy
10 expects to operate Buck units 3, 4, 5 and 6 at emission rate
11 of 1.4 pounds of British Thermal Units?

12 **A.** Yes. Yes, it does.

13 **Q.** It's that low-sulfur coal?

14 **A.** It's 1.4 pound per million BTU coal. That's what it is.

15 **Q.** You've made reference in your testimony to low-sulfur
16 coal. Is that low-sulfur coal or is it not?

17 **A.** It's 1.4 pound per million BTU coal. It is what is.
18 And some people might call it a medium-sulfur coal. Buck is
19 a small plant. It's not operating that much so...

20 **Q.** Do you call that low-sulfur coal or do you not?

21 **A.** I call it 1.4 pound per million BTU coal, so I don't
22 call it low-sulfur coal.

23 **Q.** So that's not low-sulfur coal?

24 **A.** No. But the bottom line is, the only -- we can talk
25 semantics about what is low-sulfur coal, what is not

1 low-sulfur coal.

2 The point I made yesterday is, the goal is to get
3 emissions down. Now, whether you --

4 Q. Sir.

5 A. Excuse me, I --

6 Q. Sir, I did not ask you about any goals. I asked you
7 what --

8 **THE COURT:** Let the witness --

9 **THE WITNESS:** What I'd like to do --

10 **THE COURT:** Just a minute. Let the witness explain
11 his answer.

12 **THE WITNESS:** I think this is -- this is a -- my
13 testimony yesterday made it very clear that the most
14 important thing is to get total emissions down, and the way
15 you get total emissions down is managing your fuel, perhaps
16 installing equipment. And all of these things, whether it's
17 you're using a 1.4 pound per million BTU coal or .85 pound
18 per million BTU coal, or a 5 pound per million BTU coal with
19 a scrubber, it all has to be put in the context of trying to
20 get total emissions down, and if you use a 1.4 pound per
21 million BTU coal on a small unit that doesn't run very much,
22 it's not creating a lot of pollution.

23 On the other hand, if you use a .85 pound per
24 million BTU coal, that may or may not be good in the context
25 of everything else you're doing and the way your system is

1 operated.

2 So it's -- this -- I don't think this discussion of
3 low-sulfur coal -- I think it's a distraction from what the
4 whole objective of an emissions program is, is to lower
5 emissions.

6 Q. All right, sir. And, frankly, I'm not attempting to
7 have a discussion. I simply would like you to answer whether
8 or not these particular items are low-sulfur coal or not.

9 If you cannot answer whether or not they are low-sulfur
10 coal, please say so.

11 A. I don't think -- I don't consider --

12 Q. May I ask my next question now, sir.

13 Cliffside units 1, 2, 3, 4 and 5 are expected to operate
14 in 2009 at emission rates of 1.6 pounds per million British
15 Thermal Unit. Is that correct?

16 A. That's what it says here.

17 Q. And is that or is that not low-sulfur coal?

18 A. I wouldn't consider it low-sulfur coal. I would
19 actually just call it 1.6 pound per million BTU coal.

20 Q. And in 2009, Duke Energy's Dan River units 1, 2 and 3
21 are expected to operate at 1.4 pounds per million British
22 Thermal Units, correct?

23 A. That is what it says here.

24 Q. And that is not low-sulfur coal, is it?

25 A. It's -- yeah. Correct. It is 1.4 pound per million BTU

1 coal.

2 Q. And in 2009, Duke Energy's River Bend units 4, 5, 6 and
3 7 are expected to operate at 1.55 pounds per million British
4 Thermal Units, correct?

5 A. Excuse me. Which ones again?

6 Q. River Bend's 4, 5, 6 and 7, at the bottom of the page.

7 A. That's what it says.

8 Q. And all together, that is 16 of Duke Energy's units
9 operating at emission rates above, at or above 1.4 pounds per
10 million British Thermal Units; is that correct?

11 A. That's correct. And then 16 units that are small, with
12 low capacity factors, and, therefore, contribute fairly --
13 fairly low total emissions to the total inventory.

14 Q. Duke Energy, in 2009, has indicated that it will operate
15 16 units in the state of North Carolina at emission rates of
16 1.4 pounds per million British Thermal Units or higher,
17 correct?

18 A. That's what it says here.

19 Q. And none of TVA's units operates at emission rates as
20 high as 1.4 pounds per million British Thermal Units?

21 A. I don't have that information in front of me right now.

22 Q. You testified yesterday about your view of the
23 reasonableness of TVA's emission rates.

24 Is your testimony that you do not know what TVA's
25 emission rates are?

1 **MR. GOODSTEIN:** Objection, Your Honor. That's
2 mischaracterizing the witness's testimony.

3 **THE COURT:** Sustained.

4 **BY MR. LANCASTER:**

5 **Q.** Sir, do any of TVA's units operate emission rates as
6 high as 1.4 pounds per million British Thermal Units?

7 **A.** Well, let me check my report. I have information on
8 that.

9 **Q.** Certainly. Your report is Exhibit 239 in the book.

10 **A.** Well, it was operating with 1.8 pound per million BTU
11 coal in 2005. That may have changed since then and now. So
12 I -- I can't comment on your answer.

13 **Q.** Okay. Thank you.

14 Another -- another way to achieve low sulfur dioxide
15 emissions besides using a scrubber or low-sulfur coal is to
16 use an alternative technology, such as a fluidized bed,
17 correct?

18 **A.** Yes. That's one method to control emissions.

19 **Q.** And one of TVA's units, unit number 10 at the Shawnee
20 plant in western Kentucky, is a circulating fluidized bed
21 boiler, correct?

22 **A.** Yes it is.

23 **Q.** And as a circulating fluidized bed boiler, Shawnee unit
24 10 is a low sulfur dioxide coal emitter, correct?

25 **A.** Well, it's roughly about a .45 pound per million BTU's

1 emitter, and that is -- that is relative to a bituminous, you
2 know, an eastern bituminous fuel that's low compared to a
3 PRB, that's maybe at the low end of what a PRB will do.
4 Compared to a unit with a scrubber, a modern scrubber, it's
5 high. So it's what it is. It's a .45 pound per million BTU
6 emitting unit.

7 Q. In calendar year 2002, the year that North Carolina
8 passed its Clean Smokestacks Act, TVA's system-wide sulfur
9 dioxide emissions were about 547,000 tons; is that correct?

10 A. I don't know if I have that information in front of me
11 for their 2002 emissions.

12 Q. Well, you are aware that TVA's overall emissions have
13 decreased over the past several years, are you not?

14 A. Yes. Yes, I have.

15 Q. And last year, calendar year 2007, TVA's system-wide
16 sulfur dioxide emissions had fallen to about 374,000 tons,
17 correct?

18 A. Yes. And that's good news. I'm glad to see TVA is
19 making progress at reducing its emissions.

20 Q. Whether that's good or not, is that correct, sir?

21 A. Yes. I can't say that I necessarily confirmed -- I
22 don't recall the specific number. I remember checking it; I
23 don't recall the specific number.

24 Q. Now, in your personal view, there is a better measure of
25 how well a coal-fired power plant is performing than the

1 absolute amount of its emissions, correct?

2 A. Excuse me?

3 Q. In your personal view, there is a better measure of how
4 well a coal-fired power plant is performing than the absolute
5 amount of the emissions in tons; is that correct?

6 A. Yes. Yes, as I said, and I'm sure where you're heading
7 is the emissions rate.

8 Q. That's exactly where I'm heading.

9 A. Yeah.

10 Q. And that better measure is the emission rate per unit of
11 electricity generated expressed in terms of emissions per
12 megawatt hour, correct?

13 A. Yes.

14 Q. And that could be expressed in pounds per megawatt hour.

15 A. Yes.

16 Q. It could also be expressed in tons per gigawatt hour,
17 correct?

18 A. Yes.

19 Q. That's simply two different ways to say the same thing,
20 like calling ten dollars "ten dollars" or "a thousand
21 pennies"?

22 A. Yeah. You'd have to do a little conversion, but, yes.

23 Q. You believe emissions per megawatt hour of electricity
24 generates -- measures the trade-off between environmental
25 costs, which are the pollution, versus the benefit that the

1 power plant produces, which is the electricity it makes,
2 correct?

3 **A.** That is correct, yes.

4 **Q.** If two systems are compared to each other and one of
5 them has a lower emission rate in terms of pound per megawatt
6 hour than the other, the one with a lower emission rate is
7 doing a better job in terms of the trade-off between the cost
8 of pollutant emissions and the benefit of the electric power
9 generated, correct?

10 **A.** I agree with that. It sounds like something I said.

11 **Q.** It is.

12 And TVA, in fact, currently has lower sulfur dioxide
13 emissions rates in terms of pounds per megawatt hour than the
14 coal-fired power plants operated by Duke Energy and Progress
15 Energy in North Carolina, correct?

16 **A.** I don't know. It's hard to say about 2008 because Duke
17 and Progress have a bunch of scrubbers that started this
18 year, so, it's hard to say. 2007, TVA did have a low pound
19 per -- was a little bit lower, yes.

20 **Q.** So you do know that for 2005, 2006 and 2007, TVA had
21 lower sulfur dioxide emission rates from its units than the
22 Duke and Progress plants in North Carolina, correct?

23 **A.** That may be correct. I'm not disputing it. It may
24 be -- I don't remember. I don't know if I've checked that.

25 However, the point is, at no time have I ever said that

1 Duke and Progress's emissions, historical emissions, have
2 been acceptable. They, in fact, have been unacceptably high,
3 and that was the whole motivation for the Clean Smokestacks
4 Act, to get them down to reasonable levels.

5 Q. If the evidence shows that in 2005, 2006 and 2007 TVA
6 had lower emission rates for sulfur dioxide than Duke and
7 Progress plants in North Carolina, then that will mean that
8 in 2005, 2006 and 2007, TVA was doing a better job than the
9 North Carolina utilities in terms of the trade-off between
10 the cost of sulfur dioxide emissions and the benefit of
11 electric power generated, correct?

12 A. That would be correct for SO₂, but for NOx, Duke and
13 Progress had less than half of the emissions per million BTU,
14 which is another -- another way it's -- it would trend in the
15 same direction as pounds per megawatt hour, significantly
16 lower NOx emissions on an annual basis in 2007 than TVA.
17 Less than half.

18 Q. But, sir, just to make clear that I got the answer to
19 the question that I asked, in terms of the sulfur dioxide, in
20 terms of that pollutant, TVA -- if the evidence shows that
21 TVA's emission rates were lower, then that means, in 2005,
22 2006, 2007, TVA was doing a better job than the North
23 Carolina utilities in terms of the trade-off between the cost
24 of sulfur dioxide emissions and the benefit of electric power
25 generated, correct?

1 **A.** Well, that would be true, but that's not to say that
2 Duke and Progress's emissions were at an acceptable level.
3 They're not there. Or they certainly weren't in those years.
4 They're getting there. But that was the whole point of the
5 Clean Smokestacks Act, was to get them there, because they
6 were unacceptably high.

7 **Q.** You did agree with my statement, though.

8 **A.** I agree with your statement, but I wanted to make the
9 additional point that at no point have I, or anyone I know of
10 from North Carolina, stated that Duke and Progress's
11 emissions were -- have been, up until this point, acceptable.
12 In fact, I seem to recall people testifying that they were
13 pretty unacceptable, and that was the motivation for the
14 Clean Smokestacks Act.

15 **Q.** I do want to move on to NOx now, which you just brought
16 up, nitrogen oxides.

17 All coal-fired power plants emit some amount of NOx; is
18 that correct?

19 **A.** Yes, that would be correct.

20 **Q.** And just like scrubbers for sulfur dioxide, there are
21 technologies for reducing NOx emissions, correct?

22 **A.** Yes, there are.

23 **Q.** Selective catalytic combustion is a post-combustion NOx
24 technology that is capable of providing 90 percent or more
25 removal of NOx, correct?

1 A. Yes. When it's operated, yes.

2 Q. And selective catalytic reduction is known as SCR for
3 short; is that correct?

4 A. That is correct.

5 Q. Currently, an SCR is typically considered the
6 top-of-the-line pollution control for NOx removal, isn't it?

7 A. It's -- it would be considered BACT, B-A-C-T. Top of
8 the line, I'm not sure I'm comfortable with that terminology.
9 But it's referred to -- it would be best available control
10 technology.

11 Q. And 21 of TVA's 59 coal-fired units are currently
12 equipped with SCRs, correct?

13 A. Excuse me?

14 Q. Twenty-one of TVA's 59 coal-fired units are currently
15 equipped with SCRs; is that correct?

16 A. That is correct, yes.

17 Q. In the United States, about one-third of the total
18 coal-fired generating capacity is equipped with SCR. Isn't
19 that a fact?

20 A. Again, like the whole scrubber discussion, it's a moving
21 target, so it may be closer to about half now. So it's hard
22 to say.

23 Q. Have you made that calculation?

24 A. As I said, yes, I have, but it's one of these things
25 where these things are being brought on the line, you know,

1 month by month, and so it's difficult -- it's difficult to
2 say exactly how many are on line right now. You're looking
3 at a moving target.

4 But I think a half is probably a reasonable number by
5 2010, perhaps two-thirds.

6 Q. So the number may have grown in the last year or so from
7 roughly a third to closer to a half?

8 A. Yes.

9 Q. And more than half of TVA's coal-fired generation is
10 equipped with scrubbers -- excuse me -- with SCRs; is that
11 correct?

12 A. It's about half, yes. I don't remember the exact
13 number, but that's about right -- sounds about right. But
14 they're only operated a small part of the year.

15 Q. In fact, about 60 percent of TVA's coal-fired generating
16 capacity is equipped with SCR; is that correct?

17 A. I think we did this calculation during our -- during my
18 deposition, but if that's the number, that was the number
19 that we arrived at.

20 Q. Another post-combustion NOx control technology besides
21 SCR is called selective non-catalytic reduction, correct?

22 A. Yes, that's true.

23 Q. And like everything else in this field, it has a short
24 acronym as well, SNCR. Is that correct?

25 A. That is correct, yes.

1 Q. You've been to TVA's John Sevier plant, haven't you?

2 A. Yes, I have.

3 Q. TVA has an SNCR at its John Sevier unit 1, correct?

4 A. It was being installed while I was there. I don't know
5 if it's in operation yet. I can't comment on that.

6 Q. Are you aware that TVA also has SNCR at its Johnsonville
7 units 1 and 4?

8 A. I have read things to that effect, but I can't - I have
9 no -- I can't say that I've been there to see if they're in
10 operation.

11 Q. Still another why to control NOx emissions is through
12 use of what are called combustion controls, correct?

13 A. That is correct, yes.

14 Q. And combustion controls reduce the amount of NOx that is
15 formed in the flame, correct?

16 A. Yes, they do.

17 Q. A low NOx burner is an example of a combustion control.

18 A. Yes, it is.

19 Q. Low NOx burners reduce NOx formation by carefully
20 controlling the combustion process in such a way that NOx
21 formation is minimized while still providing good combustion,
22 correct?

23 A. That would be correct, yes.

24 Q. A coal-fired power plant can have very good results in
25 NOx reduction using combustion controls, can't it?

1 A. It depends. It depends upon the particular unit.

2 Q. Although it depends, a coal-fired power plant can have
3 very good results in NOx reduction using combustion controls,
4 correct?

5 A. Yes, but with, I think, an important caveat. It depends
6 upon the particular facility, because the applicability of
7 combustion controls is very unit specific.

8 Q. In fact, Duke and Progress plan to use combustion
9 controls rather than SCRs or SNCRs to meet the requirements
10 of the North Carolina Clean Smokestacks Act at a number of
11 their North Carolina units, correct?

12 A. That is correct, yes.

13 Q. You're aware that almost all of TVA's units that are not
14 already equipped with SCRs or SNCRs use combustion controls,
15 like low NOx burners, correct?

16 A. Did you say all? Almost all?

17 Q. Yes, sir.

18 A. Yeah. Perhaps almost all, but not all.

19 Q. Most of them?

20 A. Most of them.

21 Q. Is that correct?

22 A. Some form of combustion control, yes.

23 Q. Yet another way to lower NOx emissions is to use a
24 low-NOx coal; is that correct?

25 A. Yeah, a coal that produces -- that results in a low NOx.

1 Q. In addition to TVA's 21 units that are equipped with
2 SCRs, TVA burns western coals at some of its plants that are
3 not equipped with SCRs, correct?

4 A. Yes, they do.

5 Q. For example, we discussed Powder River Basin coal a few
6 minutes ago. Boilers that burn PRB coal can have low NOx
7 emissions, correct?

8 A. They can have low NOx emission.

9 Q. And TVA's Gallatin plant burns this low NOx PRB coal,
10 correct?

11 A. Yeah. Well, it's all -- again, it's relative.

12 A typical boiler burning PRB coal would have a lower NOx
13 emission in general than if that same boiler were burning
14 bituminous coal.

15 So what the specific number would be will differ based
16 upon the unit.

17 Q. But it is true that the Gallatin plant burns PRB coal,
18 which is a lower NOx coal, correct?

19 A. That's my understanding, yes.

20 Q. I'd ask you to turn to your deposition transcript again,
21 which is TVA Exhibit 239, and I'm going to direct your
22 attention to page 209.

23 A. Yes.

24 Q. On line 2 of page 209 of your deposition, I was speaking
25 with you about the Blue Ridge Paper Products plant that we've

1 heard some testimony about.

2 I asked you: "Would you expect 9,000 tons of sulfur
3 dioxide emissions from a plant in the western North Carolina
4 mountains to have an impact on the western North Carolina
5 mountains?"

6 And what was your answer, sir?

7 **A.** I said, "I'm not an expert on impacts."

8 **Q.** You said, "I'm not an expert on impacts."

9 And then I asked you: "Would it surprise you if those
10 emissions didn't have an impact?"

11 And what was your answer?

12 **MR. GOODSTEIN:** Objection, Your Honor. He has
13 already said he's not an expert on impacts, and whether he's
14 surprised or not --

15 **THE COURT:** The objection is overruled. You may
16 answer.

17 **MR. GOODSTEIN:** Thank you, Your Honor.

18 **THE WITNESS:** It said -- okay.

19 "Would it surprise me if they didn't have an
20 impact? I really don't know. I can't make comments about
21 the impact."

22 We had witnesses, not yesterday, but two days ago,
23 who were in a better position to discuss that than I am.

24 **BY MR. LANCASTER:**

25 **Q.** I am simply attempting to cross-examine you on your

1 testimony yesterday about impacts.

2 At your deposition, did you state, sir: "I'm not an
3 expert on impacts. I can't make comments about the impact."

4 **A.** Well, I can talk -- I'm familiar with generally why
5 these pollutants are of concern, but I can't tell you
6 where -- where sulfate particles are going to form downwind,
7 but I do understand why, why it's a concern for -- why SO₂ is
8 a concern.

9 But there are other people here who will testify on
10 behalf of North Carolina who are far more -- who can go into
11 detail on how, for example, SO₂ forms sulfate and where it
12 might deposit and things like that.

13 But I'm certainly -- I would be -- being in this
14 business, I certainly understand why there are concerns about
15 these pollutants and I wouldn't be doing my job if I didn't
16 take that -- try to understand to some degree why these
17 pollutants are a concern.

18 **Q.** I simply want to confirm whether or not what you stated
19 to me at your deposition is true or not, sir.

20 Is it true that you are not an expert on impacts?

21 **A.** No.

22 **Q.** It's not true that you're not an expert on impacts?

23 **A.** It's true that I know -- I know a good deal about
24 impacts, but I'm not -- I'm not here to testify in the same
25 manner that other people are here to talk about the -- it's

1 not -- I'm not completely ignorant of impacts and -- but I
2 can -- but I can't testify on exactly how much sulfate may
3 form as a result of SO₂ emissions that are -- that are
4 transported downwind. That sort of thing I can't talk about.

5 **Q.** You testified yesterday, sir, about your belief that
6 your projection of TVA's 2013 NO_x emissions, nitrogen oxide
7 emissions, might be on the low side now that the State of
8 North Carolina has secured the vacation of the Clean Air
9 Interstate Rule. Is that correct?

10 **MR. GOODSTEIN:** The same objection earlier, Your
11 Honor. It misstates the State of North Carolina's position
12 in the CAIR litigation. The State did not seek that the rule
13 be vacated. They sought that the rule be corrected and
14 strengthened.

15 **MR. LANCASTER:** Your Honor, the D.C. Circuit
16 decision speaks for itself. The State of North Carolina was
17 the petitioner and the ruling was the vacating of the Clean
18 Air Interstate Rule. But I will rephrase the question.

19 **BY MR. LANCASTER:**

20 **Q.** Sir, your testimony yesterday --

21 **THE COURT:** I'll let the witness answer. The
22 objection is overruled.

23 **MR. GOODSTEIN:** Thank you, Your Honor.

24 **THE WITNESS:** Could you repeat the question,
25 please?

1 BY MR. LANCASTER:

2 Q. I will.

3 Your testimony yesterday was that as a result of the
4 fact that the Clean Air Interstate Rule has been vacated, you
5 believe your projection of TVA's 2013 NOx emissions might
6 actually be on the low side; is that correct?

7 A. That is correct.

8 Q. And that is because, under the Clean Air Interstate
9 Rule, TVA would have been required to run its SCRs all year
10 round, not just during ozone season, correct?

11 A. That is correct, because, right now, TVA does not
12 operate its SCRs year round, and CAIR would be the primary
13 motivator to cause TVA to operate its SCRs year round.

14 Q. And you haven't actually discussed with anyone at TVA
15 what its intentions are for year-round operations of its SCR,
16 have you?

17 A. Well, I did participate in depositions of some of your
18 witnesses and I did read the expert witness reports, and
19 particularly Mr. Scott, and Mr. Scott's plan was -- he, in
20 his -- the title was "The CAIR CAMR Plan."

21 So absent CAIR or CAMR -- and, you know, he calls it the
22 CAIR CAMR plan -- I would have to say that the assumptions
23 underlying his plan would have to be questionable at this
24 point, in light of those programs being vacated.

25 Q. And you have -- let me strike that.

1 If it is true, as you speculated yesterday, that TVA may
2 not run its SCRs year round in the year 2013 and as a result
3 may have a higher level of nitrogen oxide emissions than you
4 projected, all of those increased emissions would occur
5 outside of ozone season; is that correct?

6 **A.** That would be correct, yes.

7 **Q.** I want to talk with you now about what you call a 2013
8 base case and a 2013 Clean Smokestacks Act equivalent
9 emissions case for TVA.

10 According to you, the North Carolina Clean Smokestacks
11 Act is a yardstick for what is reasonable or proper for
12 coal-fired generating units; is that correct?

13 **A.** That's correct. That's what we used it -- we used it as
14 a yardstick, yes.

15 **Q.** And in this lawsuit, the plaintiff State of North
16 Carolina's objective is to try to get TVA's emissions down to
17 the same level that the Clean Smokestacks Act requires of
18 Duke and Progress and in the same time frame.

19 **MR. GOODSTEIN:** Objection, form. That's -- I
20 believe that misstates what the testimony was yesterday, Your
21 Honor.

22 **THE COURT:** I'll let the witness answer the
23 question.

24 **MR. GOODSTEIN:** All right.

25 **THE WITNESS:** Can you restate the question, please?

1 BY MR. LANCASTER:

2 Q. In this lawsuit, the plaintiff State of North Carolina's
3 objective is to try to get TVA's emissions down to the same
4 level that the Clean Smokestacks Act requires of Duke and
5 Progress and in the same time frame.

6 A. What I was -- we're trying to get it down to reasonable
7 levels, reasonable emission rates and rates that are
8 equivalent to what are being required of Duke and Progress,
9 and the reason is that we're not going to hold TVA to a
10 standard that's worse than Duke and Progress, that's more --
11 that's more difficult than Duke and Progress.

12 Q. If I could ask you to turn to TVA's Exhibit 240 in book
13 12.

14 A. Yes.

15 Q. If you would turn to page 41.

16 And this was a deposition that you gave as a 30(b) (6)
17 representative for the plaintiff; is that correct?

18 A. Yes.

19 Q. And if you would look at line 18 of page 41, did you
20 state, sir:

21 "But we're looking at emissions here, so we want to get
22 TVA's emissions down, down to the same level that the Clean
23 Smokestacks Act requires of Duke and Progress to get their
24 emissions down to and, you know, in the same time frame."

25 A. Yes, I see that.

1 Q. And in support of this objective, you translated the
2 North Carolina Clean Smokestacks Act cap into what you
3 considered to be an equivalent cap for TVA; is that correct?

4 A. First I developed an equivalent, CSA equivalent emission
5 rate, output-based emissions rates. Then I used those
6 output-based emissions rates to develop caps for TVA.

7 Q. And I'd like to ask you some questions about how you
8 came up with what you considered to be the CSA equivalent
9 emissions caps for TVA.

10 First, you had to get data from somewhere, didn't you?

11 A. Yes, I did.

12 Q. Some of the data you used was generation data for TVA
13 facilities and for North Carolina facilities, correct?

14 A. That's correct.

15 Q. And you obtained generation information from the Energy
16 Information Administration's website, correct?

17 A. That would be correct.

18 Q. And that's EIA for short?

19 A. That's correct.

20 Q. And you considered EIA's website to be a reliable source
21 of information about generation levels of coal-fired power
22 plants, correct?

23 A. Yes, I did.

24 Q. Some of the data you used was heat input data for TVA
25 facilities and North Carolina facilities, correct?

1 **A.** That would be correct, yes.

2 **Q.** And you obtained the heat input information from the
3 United States Environmental Protection Agency's website,
4 correct?

5 **A.** That is correct.

6 **Q.** And you also obtained emissions information from the
7 U.S. Environmental Protection Agency's website; is that
8 correct?

9 **A.** Yes, I did.

10 **Q.** And you consider the EPA's website to be a reliable
11 source of information about heat input and emissions for
12 coal-fired power plants, correct?

13 **A.** Yes, I do.

14 **Q.** The way you translated the North Carolina Clean
15 Smokestacks Act into what you considered to be an equivalent
16 for TVA's -- caps for TVA's system required projections of
17 the operations of the North Carolina plants in the year 2013,
18 correct?

19 **A.** That's correct.

20 **Q.** You didn't translate the cap on the basis of current
21 generations and current emissions, did you?

22 **A.** No, I didn't.

23 **Q.** You have -- so, in particular, you translated the North
24 Carolina Clean Smokestacks Act caps to TVA's system using
25 what you called an output-based rate that required a

1 projection of 2013 generation from both North Carolina
2 coal-fired power plants and TVA's coal-fired power plants,
3 correct?

4 **A.** That is correct, yes, by using an output-based,
5 emission.

6 **Q.** You have no training in electricity generation
7 forecasting, do you?

8 **A.** I used USEPA's forecast. That's why -- I am not in the
9 business of doing generation forecasting, but USEPA uses ICF
10 consulting and their Integrated Planning Model to do the
11 generation forecasting, and that's why I used their
12 projections for generation growth.

13 So you are correct that I don't do generation
14 forecasting as a matter in my business; however, that's why I
15 use other publicly available information that has been
16 scrutinized carefully and covers both Duke -- well, Duke,
17 Progress and TVA over the period.

18 **Q.** I apologize, sir. I didn't ask that question very well.
19 I meant to inquire about your training.

20 Is it true, sir, that you have no training in
21 electricity generation forecasting.

22 **A.** No, I'm not -- I don't recall having any course work in
23 electricity generation forecasting, but I'm not sure that
24 people who are in that business go to college in generation
25 forecasting.

1 Q. You do not hold yourself out as an expert in electricity
2 generation forecasting, do you?

3 A. I did not represent myself as such, but I do work on a
4 regular basis with ICF Consulting and USEPA in providing both
5 input and interpreting output of the Integrated Planning
6 Model, which is an established, well documented, highly
7 scrutinized electricity generation forecasting tool.

8 Q. So you used the Integrated Planning Model, which is
9 called IPM for short.

10 A. Yes. I used IPM results produced by USEPA.

11 Q. IPM doesn't give you generation forecasts, does it?

12 A. Well, it gives you heat inputs.

13 Q. It doesn't forecast generation, does it?

14 A. Well, heat input is directly related to generation.

15 Actually, it does do generation, but the parsed output that
16 is available on EPA's website just shows heat inputs.

17 Q. You didn't use any generation projections in terms of
18 megawatt hours from IPM in this case, did you?

19 A. I used the heat inputs, which are directly proportional
20 to the generation.

21 Q. But just to be clear, you didn't use any generation
22 forecasts from the IPM model in terms of megawatt hours in
23 your work in this case, did you?

24 A. No. I didn't have the megawatt hour data. That was not
25 as part of the parsed data that EPA makes available.

1 Q. And you didn't simply take the information from IPM.

2 You also had it altered in some ways, didn't you?

3 A. I'm not sure what you're -- if you could make your
4 question more clear. I'm not sure what you mean.

5 Q. I will try to do that.

6 The IPM information that you used didn't contain any
7 information about the operation of Cliffside unit 6; is that
8 correct?

9 A. Actually, the IPM did project additional capacity in
10 North Carolina that I did not -- that I did not include in
11 the overall heat inputs projected for Duke and Progress.

12 Q. If you'll look at Exhibit 241, which is your expert
13 report, on page 18. In the middle of the page, shortly above
14 that Table 2, maybe about almost halfway up that paragraph --

15 A. Yes.

16 Q. -- it says: "However, because IPM predicts new
17 generating units but not expansion of existing generating
18 plants, the IPM projections do not specifically include the
19 effect of replacing Cliffside 1 through 4 with two
20 800-megawatt units." Is that correct?

21 A. Well, it's additional units, yes. What I did -- let me
22 explain what I did.

23 Q. I'm not actually asking you to explain. I'm asking you
24 to confirm whether that's true or not.

25 MR. GOODSTEIN: Your Honor, can we please let the

1 witness be allowed to explain his answer? Thank you.

2 **THE COURT:** You may explain your answer.

3 **THE WITNESS:** Yes. This is what -- I provide --

4 the data I provided to TVA was the -- as part of your
5 discovery, I provided to TVA the parsed output that I used
6 for the Duke and Progress plants for the projected heat
7 inputs.

8 In addition, what I didn't -- what wasn't shown
9 there, there were -- it did project additional generating in
10 North Carolina, but it wasn't explicitly identified as Duke
11 or Progress. What it -- so Cliffside was not -- was not part
12 of the table that I provided as the Duke and Progress heat --
13 heat inputs, parsed heat inputs. What it -- the way I
14 addressed Cliffside was making an adjustment, because the
15 fact that IPM projects additional coal capacity in North
16 Carolina, A, does not necessarily mean it's going to happen,
17 and, B, doesn't necessarily mean it's going to go to Duke or
18 Progress.

19 So it wasn't until I saw that Cliffside was going
20 to be actually added that I made that adjustment for the fact
21 that there would be a net increase in capacity for Duke of
22 510 megawatts.

23 **Q.** And let me return to what I was attempting to ask, which
24 is that I was seeking confirmation that this IPM data you
25 used to make projections did not include any information

1 about a projection of any operation at all of the new
2 Cliffside unit; is that correct?

3 A. It did not explicitly identify the Cliffside unit.

4 Q. And then you adjusted the information in order to
5 include generation from and calculate generation from the new
6 Cliffside unit; is that correct?

7 A. That is correct, yes. And that adds a couple percent --
8 it makes a couple percent difference. That's about it.

9 Q. The IPM model has limitations, doesn't it?

10 A. Well, every model has limitations.

11 Q. In fact, there is uncertainty associated with any
12 forecast of electric load growth into the future, isn't
13 there?

14 A. That's right. And uncertainty cuts both ways; it can be
15 higher or lower.

16 Q. But, in fact, the generation growth assumptions you used
17 were on the high side already, weren't they?

18 A. They were -- they were -- they were the results of the
19 IPM model and they were -- they were within reason;
20 admittedly high, but within reason.

21 Q. We're still on page 18 of your expert report, if you
22 still have it open. I think it's about one sentence higher
23 up in the paragraph you describe the generation growth rate
24 assumptions that you used for Duke and Progress.

25 Did you state, sir: "This growth rate, while high, can

1 be accommodated with existing units."

2 A. What page is this?

3 Q. Page 18.

4 A. And where on this page? Where on this page? I'm not
5 sure.

6 Q. It's the middle paragraph, shortly above Table 2.

7 A. Yes. Yes, that's true.

8 Q. So you used a high growth rate to project future
9 generation of Duke and Progress in North Carolina, correct?

10 A. Well, it's a growth rate that happens to be high, but it
11 doesn't mean it's high relative to what would really happen.
12 It may be exactly what will happen.

13 Q. But you used the word "high" in your report to describe
14 the growth rate, correct?

15 A. Yes, I did use that word. Yes.

16 Q. Now, generation growth assumptions you made here, those
17 assumptions had a significant effect on the TVA emissions cap
18 you have determined, or its equivalent, to the North Carolina
19 Clean Smokestacks Act, correct?

20 A. Yes, it does have an effect. Yes.

21 Q. Because the way your translation methodology works, the
22 higher the generation you forecast in North Carolina, the
23 lower the cap you determine for TVA; is that correct?

24 A. Well, it's not my forecast, just to be clear. This is
25 USEPA's IPM forecast for heat input. So just to make it

1 clear for the Court that this -- I did not make up these
2 numbers. These numbers were produced by USEPA.

3 Q. And your testimony will speak for itself. The Court
4 will recollect what we just covered.

5 Let me rephrase that question to address your concern.

6 The way your translation methodology works, the higher
7 the generation projection for North Carolina that you use,
8 the lower the cap you determine for TVA; is that correct?

9 A. Not exactly. It's actually relative growth rates.

10 Okay? If TVA had had the same growth rate as North Carolina,
11 there would be -- growth would have no effect.

12 So it's how the growth rates, the projected growth
13 rates, compare to each other.

14 Q. Let me try rephrasing it again.

15 Because of the way your translation methodology works,
16 the higher generation forecast you use for North Carolina,
17 the lower the emission rate you use to calculate TVA's cap;
18 is that correct?

19 A. The higher the -- the higher the growth rate -- well,
20 the higher the relative growth rate of North Carolina
21 versus -- or rather Duke and Progress versus TVA, the -- that
22 would result in a lower equivalent emissions rate and,
23 therefore, would reduce the cap.

24 But as I pointed out yesterday, even if we take out the
25 effect of growth, TVA, by Mr. Scott's projections, he's not

1 even -- you know, he's not even close.

2 Q. You did point that out yesterday.

3 Now, what you acknowledge is that your methodology, if
4 it is erroneous in its assumptions of generation growth for
5 Duke and Progress in North Carolina, then that does mean that
6 the cap that you specified for TVA is lower than it would
7 have been had you not made the errors in your generation
8 assumptions; is that correct?

9 A. Well, errors --

10 MR. GOODSTEIN: Objection to form, Your Honor.

11 THE WITNESS: "Errors" are your characterization.

12 THE COURT: Overruled.

13 THE WITNESS: These are -- you know, I used an
14 approach that is consistent with what was used in developing
15 State NOx allocations for the NOx SIP Call that was
16 challenged in court and was yet upheld.

17 So this is a -- the approach of using the IPM to
18 project growth rates for generation and use that, those
19 growth rates as a methodology for allocating emissions among
20 different places, that's been -- that's been scrutinized. I
21 used the very same tool that's been scrutinized and examined
22 in a number of lawsuits, and it's been upheld.

23 BY MR. LANCASTER:

24 Q. I apologize again, sir. I'm just not doing a good job
25 of asking my questions clearly today. Maybe these late

1 nights are getting to me.

2 What I'm trying to confirm, sir, is, if your generation
3 growth projection, the one that you used for North Carolina's
4 generation in the year 2013, if it is higher than it should
5 be, the result is that the cap you specified for TVA is lower
6 than it needs to be in order to be equivalent. Is that
7 correct?

8 **A.** No, because what -- what matters -- first of all, I
9 don't know what you mean by what it should be. You'll have
10 to explain what "what it should be" is.

11 And second, what matters in the -- in the estimation
12 method is not North Carolina's growth rate in isolation; it's
13 what it is relative -- or rather Duke and Progress's growth
14 rate isolation; it's what it is relative to TVA's projected
15 growth rate.

16 And the fact of the matter is that these growth rates
17 are consistent with what is happening on the ground. We
18 have -- we have Duke and Progress trying to build new
19 capacity, new coal-fired capacity. Duke wanted to build more
20 capacity than that 800 megawatts. We don't see TVA trying to
21 build new coal-fired capacity. In fact, TVA is looking at,
22 you know, some -- Mr. Scott said he's going to have some, you
23 know -- planning on some reduced operations in some years
24 just because of reduced load demand.

25 I mean, this is -- the plans of utilities are exactly

1 consistent with what these projections are, so I don't -- you
2 know, when you say "what it should be," I think what they are
3 is pretty -- is probably pretty accurate.

4 Q. Let me try it this way, sir. If you could turn to your
5 deposition, which is TVA Exhibit 239 in book 12.

6 On page 195 of your May 16, 2007 deposition, line 2, I
7 asked you the question:

8 "Using the methodology that you used, if you
9 overestimated the North Carolina control generation, that
10 means that you underestimated the TVA translated cap and set
11 it too low. Is that correct?"

12 And your answer was:

13 "In the event I did overestimate, in the event it was
14 overestimated, it would have result of having a lower cap for
15 TVA."

16 Is that correct?

17 A. Yes. And I have a better explanation down in -- which
18 clarifies it: "If for some reason the generation, anything
19 that causes the generation of North Carolina to be" --

20 (Interrupted by court reporter.)

21 A. Oh, excuse me. I'm sorry.

22 "If for some reason the generation, anything that causes
23 the generation in North Carolina to be higher, under this
24 methodology, would tend to cause an equivalent cap for TVA,
25 assuming all other things being equal" -- my emphasis here --

1 "to come out a little bit lower."

2 So what really matters is -- sure, growth rate -- higher
3 growth rate for Progress and Duke, all other things being
4 equal, results in a lower -- a lower emissions rate and,
5 therefore, a lower cap. But if -- but what really matters is
6 a relative growth rate, just to be clear for the Court.

7 But the whole purpose of this, and I want to explain the
8 rationale, is -- as I discussed yesterday, the whole idea is
9 to make sure that we have roughly equivalent emission rates,
10 and because an emission rate is an indication of more or less
11 the difficulty, first of all, of reducing emissions and so
12 you want -- you would not want -- TVA is in a very good
13 position to be able to add generation through nuclear
14 capacity. Duke and Progress are not in that position. So
15 it's not surprising that Duke and Progress would expect
16 higher growth in their fossil generation than TVA.

17 And so the whole notion is to not cause certain regions
18 to be unduly penalized because, perhaps, they don't have
19 access to other forms of electrical generation.

20 Q. Sir, the way your methodology that you employed here
21 works, anything that lowers your North Carolina generation
22 for heat input projections would have the resultant effect of
23 raising the TVA cap. Isn't that correct?

24 A. If that were the only thing that changed, yes.

25 Q. And let's stay on page 195 of your deposition, starting

1 at line 24, carrying over to page 196. I asked you:

2 "After the explanation you just gave me.

3 "That's correct.

4 "That's what I was getting at."

5 Then I asked you: "Conversely, anything that lowers
6 your North Carolina generation or heat input projections
7 would have the resultant effect of raising the TVA cap."

8 , And your answer was: "That's the way the methodology
9 worked out, yes."

10 Is that correct?

11 A. That's correct. That's what I said. And just to
12 clarify, what I intended was all other things being equal, if
13 that's the only thing you change.

14 Q. And I would like now to discuss some issues that may
15 affect the lowering of the North Carolina generation
16 projections that you used.

17 In your projection of North Carolina's 2013 generation,
18 you assumed that Duke would be operating at least one large,
19 new coal-fired generating unit at its Cliffside plant,
20 correct?

21 A. Well, yes, yes, I did. I did assume that.

22 Q. And you increased your projection of North Carolina's
23 2013 generation by over 4,000 megawatt hours on account of
24 the expected new Cliffside unit, correct?

25 A. I have to take a look at my expert report and see that.

1 Q. Certainly, sir.

2 A. I don't see the 4,000 megawatts here.

3 Q. Are you on page 18, sir?

4 A. Yes. I'm trying to find where -- what part of page 18
5 are you?

6 Q. Pardon me?

7 A. What part of page 18 are you referring to? I mean, you
8 took a number; I assume you took it out of my report. So ...

9 Q. You described a Cliffside adjustment that you made to
10 the generation. Before you made the adjustment, you had a
11 projection of 94,231,000 megawatt hours, and after you made
12 the adjustment for Cliffside, you had a projection of
13 98,659,962 megawatt hours; is that correct?

14 A. That's what it says here, yes.

15 Q. So that's really more 4 point -- well, these are
16 units -- these are -- what are the units?

17 A. The units?

18 Q. Yes.

19 A. You see megawatt hours?

20 Q. Are they megawatt hours? So is that 4 million megawatt
21 hours?

22 A. It might be. It might be 4 million megawatt hours.

23 Q. Pardon me?

24 A. That would be around 4 million megawatt hours.

25 Q. I'm sorry. It wasn't 4,000; it was 4 million, wasn't

1 it?

2 **A.** Yeah.

3 **Q.** So you increased your projection of North Carolina's
4 2013 generation by over 4 million megawatt hours on account
5 of the expected new Cliffside unit, correct?

6 **A.** That appears to be the case, yes.

7 **Q.** And your assumption that Duke will have a new
8 800-megawatt unit operating in 2013 in Cliffside had the
9 effect of making the emissions rate that you applied to TVA
10 lower than it would have been without that, correct?

11 **A.** That -- yeah. That assumption has that effect, yes.

12 **Q.** Does your assumption that Duke will have a new
13 800-megawatt unit operating in 2013 in Cliffside have the
14 effect of your calculating a lower cap for TVA's system than
15 you would have calculated without assuming this new Duke
16 Cliffside unit to be operating? Is that correct?

17 **A.** Yes, a few percent. And, you know, frankly, if what
18 North Carolina would like TVA to do versus what TVA is going
19 to commit to were, the difference were only a few percent, I
20 have a feeling that that would really be, you know -- that
21 would be overcome, but this -- the difference between what
22 TVA's plan and what North Carolina would like TVA to do is a
23 heck of a lot more than a few percent.

24 So, you know, even if you take Cliffside out of the
25 equation, it's a small difference, and TVA still falls far

1 short of where -- where North Carolina would like them to be.

2 Q. Just to confirm the answer to my questions, your
3 assumption about the new Cliffside unit did have the effect
4 of your specifying a lower cap for TVA, and would be the case
5 without assuming this new generation, correct?

6 A. The last part threw me off.

7 Q. Your assumption that Duke will have a new 800-megawatt
8 unit operating in 2013 at Cliffside had the effect of your
9 calculating a lower cap for TVA's system than you would have
10 calculated without assuming this new Duke Cliffside unit will
11 be operating, correct?

12 A. It's true, the effect of adding Cliffside does end up
13 reducing the cap somewhat.

14 Q. That's what I wanted to confirm.

15 A. Yes.

16 Q. Now, this new 800-megawatt unit at Cliffside has not
17 been built yet, has it?

18 A. No, it hasn't. It's under construction.

19 Q. So when you made your projections of Duke Energy's 2013
20 coal generation, you included this Cliffside unit that isn't
21 operating yet, correct?

22 A. That's true, and it's projected to be operating in 2013.

23 Q. You also included in the generation projections that you
24 used units that won't be operating anymore in 2013, correct?

25 A. I actually netted them out. The Cliffside 1 through 4

1 got netted out.

2 Q. Right. You were aware that Cliffside 1 through 4 were
3 closing and you netted them out, correct?

4 A. That's correct.

5 Q. And you did not assume operation from Cliffside 1
6 through 4, which are expected to be closed down in 2013,
7 correct?

8 A. That is correct.

9 Q. But you did assume generation from Duke Energy's Buck 3
10 and 4 units, correct?

11 A. I believe I did, but I don't --

12 Q. Pardon me?

13 A. I believe I did, but I don't have that data in front of
14 me to be able to refer to.

15 Q. And you are now aware, are you not, that Duke Energy has
16 announced that it will close these two Buck units before
17 2013, correct?

18 A. That, I wasn't aware. That they are going to close
19 them, I was not aware. They're small units, so that would be
20 a very small effect.

21 Q. But if the evidence shows that the Buck units 3 and 4
22 are going to be closed before 2013, that means you included
23 within the generation projection that you used, generation
24 from units that will not even be operating, correct?

25 MR. GOODSTEIN: Objection to the question, Your

1 Honor. That's not what the evidence is going to show.

2 **THE COURT:** Overruled.

3 **THE WITNESS:** Well, to my knowledge, I'm not aware
4 that Buck -- Buck 1 and 2 are being shut down before 2013.

5 **BY MR. LANCASTER:**

6 **Q.** I believe I said Buck 3 and 4. If I didn't, I was
7 mistaken.

8 **A.** Oh, Buck 3 and 4. Okay.

9 I'm not aware of that. If -- if those units were being
10 shut down, that would affect the outcome. But it would be a
11 very small impact because those are very -- those are very
12 small units.

13 **Q.** This is exhibit -- an extract from Plaintiff's Exhibit
14 10, which is already in evidence, that we were looking at
15 earlier.

16 What level of emissions does it indicate that Buck units
17 3 and 4 will have in the year 2013?

18 **A.** It says zero, but that doesn't necessarily mean that
19 they're being retired by that time.

20 I mean, I know Mr. Scott has, in his plan, units that
21 he's planning to have out of service in 2013 for a period of
22 time, so they would be zero during that period of time that
23 they were out of service. So it could be that they're
24 temporarily taking them out of service for another reason.

25 **Q.** You acknowledge, do you not, sir, that Duke Energy's and

1 Progress Energy's own projections of generation growth would
2 be good check on projections you used, correct?

3 A. Not necessarily.

4 Q. In making your projections for the year 2013, you could
5 have looked at Duke Energy's and Progress Energy's plans to
6 see how those utilities perceived their own possible
7 generation growth outlook, correct?

8 A. I possibly could, but the problem with that is, if
9 you're using projections from Duke, Progress, and presumably
10 TVA, because then I'd have to get information from TVA, I'd
11 be using three different sources of information prepared for
12 varying -- possibly for different purposes, using different
13 assumptions, and it would be almost like comparing apples and
14 oranges.

15 The approach I used was a single -- the results of a
16 government projection, USEPA projection, a single entity that
17 is credible, that used an approach that stood up to scrutiny
18 and addressed all three utilities, and specifically for the
19 purpose of trying to forecast emissions. Okay. That was --
20 that's the purpose of the IPM, is to try to forecast
21 generation and emissions.

22 So I think, certainly, I could have gone to three
23 different entities and tried to mix and match information and
24 hopefully come up with an estimate, but I used another
25 approach that I felt was the best approach to use.

1 Q. To be clear, you did not check the generation growth
2 assumptions for Duke and Progress that you used in your
3 calculations against the generation growth projections that
4 Duke and Progress were making for themselves; is that
5 correct?

6 A. No, I didn't, because, and for the reasons I explained.
7 You end up with information that may be -- may be used for
8 different purposes. Sometimes they show total generation
9 growth, and I'm focusing on fossil generation growth.

10 Q. You didn't make any effort to get any information from
11 the North Carolina Public Utilities Commission concerning
12 Duke Energy's and Progress Energy's announced plans for
13 generation growth, did you?

14 A. I know that I looked at information from them during the
15 course of this, but I used -- for the purpose of my growth
16 projections, I used USEPA's IPM projections.

17 Q. In fact, when you prepared your projections, you weren't
18 even aware that Duke Energy files something every year with
19 the North Carolina Public Utilities Commission called an
20 Integrated Resource Plan, were you?

21 A. I don't recall if I was or a I wasn't. I may not have
22 been aware when I did that. But I don't recall.

23 Q. But you never reviewed any annual plan filed by Duke
24 Energy with the North Carolina Public Utilities Commission,
25 did you?

1 **A.** I have reviewed the annual plans, but I didn't use them
2 as part of formulating my assumptions for growth.

3 **Q.** If you would turn to your deposition, please, and
4 Deposition Exhibit -- excuse me -- it's Trial Exhibit 239 in
5 book 12. And we're going to be on page 92.

6 **A.** 239?

7 **Q.** At the bottom of the page, line 22, I asked you:
8 "To the best of your knowledge, you've never reviewed
9 any annual plan filed by Duke Power Company with the North
10 Carolina Public Utilities Commission."

11 And your answer on the next page was:

12 "As far as I can recall, I don't recall doing that."

13 Is that correct?

14 **A.** That's correct. That's correct. And I know that I have
15 seen them, perhaps, since that point. But your question was
16 I never reviewed it, and I can only testify as to what I know
17 today.

18 **Q.** And as of the time that you made and relied on
19 generation growth projections in order to translate a cap to
20 TVA, you had not examined the Duke Energy's or Progress
21 Energy's own projections of their generation growth, had you?

22 **A.** Perhaps I didn't. I know that I didn't use them for
23 that purpose, even if I had.

24 **Q.** You're aware that Duke Energy and Progress Energy filed
25 a Clean Smokestacks Act report every year; is that correct?

1 A. Yes, I know that.

2 Q. And you're aware that it contains information that could
3 be used to calculate Duke Energy's, for instance, projections
4 of utilization of coal plants; is that correct?

5 A. Excuse me. Can you repeat the question, please?

6 Q. Are you aware that, what we were just looking at on the
7 screen, the Duke Energy Clean Smokestacks Act filings provide
8 emission rates and BTU assumptions that could be used to
9 determine how many BTUs they expect from each unit in that
10 year; is that correct?

11 A. Yes. Potentially, yes, we do that.

12 Q. But you didn't rely on that either, did you?

13 A. No, I didn't.

14 Q. In fact, you only briefly skimmed through the reports
15 that Duke Energy filed under the Clean Smokestacks Act,
16 correct?

17 A. I probably did to familiarize myself.

18 The point was the case is not about Duke and Progress;
19 the case is about TVA and -- and I used the growth
20 projections from USEPA. And so I was not looking, examining
21 them for the purpose of getting -- getting their growth
22 projections.

23 Q. But I'm simply attempting to find out whether or not
24 it's true that in relying on growth assumptions for the North
25 Carolina generation growth and using those to specify a cap

1 for TVA, you did not consult and rely on the publicly
2 available information from Duke Energy about its expectations
3 for how much it would operate its power plants in 2013, did
4 you?

5 **A.** It's true, I did not rely on that.

6 **Q.** Now, in calculating a cap for TVA's system that would be
7 equivalent to the Clean Smokestacks Act, you considered both
8 an input-based approach and an output-based approach,
9 correct?

10 **A.** That is correct.

11 **Q.** And the input-based approach, using your calculations,
12 would have resulted in a TVA sulfur dioxide cap nearly
13 10,000 tons per year higher than the cap level of the
14 output-based approach, correct?

15 **A.** Perhaps it would have. I'd have to check my report, but
16 it --

17 **Q.** It's page 19, Table 3.

18 **A.** Yeah. About a little over 9,000 tons, yes.

19 **Q.** But you chose the output-based approach with a result of
20 a 10,000-ton lower cap; is that correct?

21 **A.** That is correct, yes.

22 **Q.** Now, when you prepared this translation of the North
23 Carolina Clean Smokestacks Act to TVA's system, the coal
24 fleets of Duke and Progress in North Carolina were only about
25 three-fourths the size of TVA's in terms of the amount of

1 their generation; is that correct?

2 A. That sounds about right. In terms of generating
3 capacity, right.

4 Q. In terms of actual generation.

5 A. Actual generation, that may be about right.

6 Q. Now, although you started out with numbers in which Duke
7 and Progress plants in North Carolina were generating only
8 about three-fourths as much electricity as TVA, the numbers
9 you used to translate the cap project that by the year 2013
10 the two systems are almost equal in generation; is that
11 correct?

12 A. They do come out close, yes.

13 Q. Now, I want to ask you -- did the witness answer?

14 A. I'm reading my -- reading my report so I can -- so I can
15 give you an accurate answer.

16 Q. I apologize. I thought you had confirmed that.

17 A. Yes. Projects TVA would be a little bit higher, just a
18 little bit larger, yes.

19 Q. But approximately; is that correct?

20 A. Yeah, similar. Approximately.

21 Q. Now, you specified a mercury cap for TVA as well, in
22 addition to a sulfur dioxide cap and NOx cap; is that
23 correct?

24 A. No, I did not specify a mercury cap.

25 Q. So there's no mercury cap being sought in this lawsuit?

1 A. None that I'm aware of.

2 Q. Now, you indicated that the cap you have calculated for
3 TVA's system is, according to you, equivalent to the
4 requirements of the North Carolina Clean Smokestacks Act,
5 correct?

6 A. Excuse me?

7 Q. The cap that you have calculated for TVA's system is,
8 according to you, equivalent to the requirements of the North
9 Carolina Clean Smokestacks Act, correct?

10 A. That is correct, yes.

11 Q. The North Carolina legislature gave Duke and Progress
12 more than ten years, from the summer 2002 passage of the
13 North Carolina Clean Smokestacks Act to the beginning of
14 2013, to achieve compliance with the final sulfur dioxide
15 limits under the Clean Smokestacks Act, correct?

16 A. Yeah. About ten, ten and a half years, correct.

17 Q. Your proposed cap, if effective starting in 2013, would
18 give TVA less than five years to achieve compliance, correct?

19 A. Yes. That would -- that's what it works out to, yes.

20 Q. Now, you have testified that although TVA would have
21 less than five years, in your opinion it is feasible for TVA
22 to build all the pollution controls necessary to comply with
23 this cap you prescribed in five years or less, correct?

24 A. Yes, I have.

25 Q. And that could require design and construction work for

1 scrubbers on as many as 41 of TVA's units that are not either
2 equipped with scrubbers right now or have scrubbers under
3 construction; is that correct?

4 **A.** That number sounds about right, but I'd have to add it
5 up.

6 **Q.** TVA had 59 units; is that correct?

7 **A.** Yes, it does.

8 **Q.** We take out Shawnee 10, the fluidized bed; is that
9 correct?

10 **A.** Yeah. Make it 58.

11 **Q.** And we take out the seven scrubbers that are in
12 operation right now?

13 **A.** Yeah.

14 **Q.** We take out the Bull Run scrubber.

15 **A.** Okay.

16 **Q.** And we take out the nine units at Kingston.

17 **A.** Okay.

18 **Q.** So that could require design and construction work for
19 scrubbers on as many as 41 of TVA's units; is that correct?

20 **A.** Perhaps. I mean, if you can -- if TVA -- as I said, TVA
21 could find ways to mitigate the need for scrubbers.

22 **Q.** But your testimony is that if it is 41 units that have
23 to be scrubbed, it is feasible for TVA to design and build
24 all those scrubbers by January 1st, 2013, correct?

25 **A.** Well, it's -- let me just -- I'm not sure if -- I don't

1 know if you include Widows Creek 1 through 6 or Johnsonville
2 in that 41, because I don't think -- I don't believe TVA
3 would necessarily need to scrub Johnsonville or Widows Creek
4 1 through 6, as I indicated in my supplemental expert report.

5 Q. But your testimony is that even if they do need to do
6 that, it is feasible to build those scrubbers, correct?

7 A. No. My testimony is that TVA can achieve those emission
8 limits by 2013.

9 Now, there's is no question that as the clock ticks and
10 2013 approaches, TVA is going to have to pedal faster to
11 get -- to cover the same distance, but I don't believe that
12 you necessarily need to scrub every one of those units, as I
13 indicated in my supplemental expert report.

14 Q. I'm showing you again on the monitor what has been
15 admitted as Plaintiff's Exhibit 54, which is a summary of the
16 control scenarios that you outlined in your initial report;
17 is that correct?

18 A. That was in my initial report, correct.

19 Q. And you indicated an FGD at Johnsonville; is that
20 correct?

21 A. Well, I did say that this was one approach. But I also
22 said in that report that by reducing emissions at Paradise 1
23 and 2, reducing emissions at Widows Creek scrubbers, and also
24 by increased use of low-sulfur fuels, TVA can mitigate the
25 need to install scrubbers.

1 I also indicate in my supplemental report that, indeed,
2 because TVA's plan incorporates these recommendations that I
3 put in my report, that I put in my report before even seeing
4 your plan, that it's not necessary to install scrubbers at
5 Widows Creek 1 through 6 or at Johnsonville in order to
6 achieve the emission limits that are -- that we developed.

7 So --

8 Q. What is --

9 A. And as I stated yesterday in my testimony, TVA, with --
10 if it just -- if it just accelerated the existing April 2007
11 plan, it can get under those equivalent emissions limits. So
12 it's simply a matter of accelerating the plan that you
13 already have.

14 Q. In other words, TVA's plan, in your view, is a
15 reasonable one, is that correct, in terms of what is to be
16 accomplished?

17 A. If T -- not in terms of time. The end goal -- the end
18 goal, I think -- I think the ultimate end goal, which is
19 pretty far off, based on my estimate, if these -- if you
20 do -- if TVA does everything that it states in its plan and
21 actually achieves emissions levels on its scrubbers that I
22 projected that the scrubbers are capable of and experience at
23 Paradise has shown -- Paradise 3 has shown they are capable
24 of, TVA will be able to get under the -- get under those
25 caps. But it's a long way off.

1 And without -- in light of the fact that the basic
2 premise of that plan went away on Friday, okay -- the
3 underlying assumptions of TVA's plan disappeared on Friday,
4 therefore, it's very hard to believe that TVA -- it's very
5 hard to have any confidence that even if that plan were --
6 the objective were to actually follow through with that plan,
7 that, in light of recent events, that they really would,
8 because the underlying assumptions are all gone.

9 **Q.** Let me direct your attention back to this exhibit. This
10 is a scenario that you outlined in your expert report as a
11 possible way for TVA to comply; is that correct?

12 **A.** Yes. And I also said that there are also easier ways.

13 **Q.** I understand that.

14 You did not outline, sir, an unfeasible scenario, did
15 you?

16 **A.** Excuse me?

17 **Q.** This is not an unfeasible scenario that you outlined?

18 **A.** This was approach that could get you under the cap. But
19 as TVA waits, okay, and delays, and 2013 approaches, in the
20 event a cap is imposed, it's fair to say that certain options
21 may get ruled out. You'll still be able to reach it as time
22 passes, but there may be a point at some point in the future
23 where it might be very difficult to do it. But, certainly,
24 at some point you might not be looking at limestone forced
25 oxidation systems and going to high-sulfur coal will save you

1 some fuel costs; you might end up sticking with the, you
2 know, 1.2 pound per million Appalachian coal and put in spray
3 dryers, which will be a little bit easier to install.

4 But there are multiple ways of doing it, okay, and --

5 Q. And one of them, sir, is what you outlined --

6 MR. GOODSTEIN: Excuse me, Your Honor. Can the
7 witness complete his answer?

8 THE COURT: Yes.

9 MR. GOODSTEIN: Thank you.

10 THE WITNESS: When I put this together in 2006, I
11 identified this was one way for TVA to meet its goals.

12 BY MR. LANCASTER:

13 Q. That's the point I'm trying --

14 A. But I recognize that there are multiple ways to do it.
15 And, unfortunately, as the clock ticks, TVA -- and TVA --
16 unless TVA starts to pedal faster -- and it's good that TVA
17 has done a number of things, at Kingston, Bull Run; that
18 makes the job easier, that much easier. So if you pedal even
19 faster, it makes the job -- it makes it much more likely that
20 you'll have more options at your disposal.

21 But this isn't the only approach. There are multiple
22 approaches that TVA can employ to get under these caps.

23 Q. Did you complete your answer, sir?

24 A. Yes, I did.

25 Q. Whether there are multiple approaches or not, what we

1 are looking at is one of them; is that correct?

2 A. That is true, yes.

3 Q. And your testimony is that what we are looking at in
4 Exhibit 54 is a feasible approach; is that correct?

5 A. Yes, it is.

6 Q. And it could require construction of 41 scrubbers that
7 are not currently under construction -- excuse me --
8 scrubbers at 41 units that are not currently under
9 construction, all to be completed in less than five years; is
10 that correct?

11 A. Well, if that's what you chose to try to do, but as I
12 identified, it would not be -- I don't think TVA would -- I
13 don't think, in light of the information that I -- my
14 analysis in the report, in both expert reports, I said that
15 you wouldn't need to install all these -- wouldn't really
16 need to install all these scrubbers.

17 Let me finish. And so it's not 41 units that need to be
18 scrubbed. You can take off Johnsonville and Widows Creek 1
19 through 6. So you don't need them. You can deduct 16
20 scrubbers. Okay. That gets you down to 25. And so it's not
21 41. It's 25 units to be scrubbed.

22 And you're making good progress at Bull Run and
23 Kingston, and, hopefully, we'll see more progress at John
24 Sevier, and then, you know, I think it's -- the fact that
25 you're making progress on the existing scrubbers is a

1 positive sign and gets you closer to the end goal.

2 Q. Progress Energy is putting scrubbers on eight units,
3 correct?

4 A. Yeah. That's my recollection.

5 Q. Duke is retrofitting 12 units with scrubbers, correct?

6 A. That seems about right, yeah.

7 Q. That totals 20 units; is that correct?

8 A. Yes.

9 Q. In your opinion, Duke Energy and Progress Energy could
10 have built all those scrubbers, as necessary to comply with
11 the North Carolina Clean Smokestacks Act, in no more than
12 five years from the time that act was passed in 2002; is that
13 correct?

14 A. I believe they could have.

15 Q. So they could have had all those scrubbers in place by
16 last summer; is that correct?

17 A. I think they potentially could have, yes.

18 Q. So Duke and Progress could have achieved the final Clean
19 Smokestacks Act compliance levels of 130,000 tons per year by
20 2007; is that correct?

21 A. Well, the act was passed in the middle of 2002, so it
22 probably would have been the middle of 2007, but -- so by
23 January 1, 2008, perhaps.

24 It's -- I wasn't -- I wasn't -- I wasn't part of the
25 deliberations with them and North Carolina, so I can't

1 comment on why that -- on the dates, but it could have -- why
2 the dates were chosen as they were, but I believe that they
3 potentially could have done it in that time.

4 Q. So you don't know why the North Carolina General
5 Assembly gave Duke and Progress ten years to do what,
6 according to you, could have been done in five; is that
7 correct?

8 A. I don't know, but what I can say is that, in 2002,
9 utility industry was still trying to figure out -- getting
10 used to running SCRs, which were new technology to them. I
11 think many of them felt somewhat uncomfortable with some of
12 this technology. I think today we now know that this
13 technology works, it's available, it's not -- you know, I can
14 remember people thought all these SCRs were going to cause
15 coal-fired power plants to shut down, and, lo and behold, all
16 these power plants now have SCRs; you know, 200 units have
17 SCRs.

18 So I think, back then -- you have to look back to what
19 people were thinking back then. There was a lot of
20 uncertainty. And what we've seen with the different filings
21 from Duke and Progress, you see that the emissions rates that
22 they were projecting for these scrubbers have gone down
23 because, as they've learned more about how these scrubbers
24 work and how efficient they are, they're more comfortable
25 with it.

1 So I think today it's a different story. People are
2 more comfortable with this technology than they were in 2002.

3 **Q.** The North Carolina Clean Smokestacks Act has NOx limits
4 that are earlier -- NOx caps that go in place at an earlier
5 time than the sulfur dioxide cap; is that correct?

6 **A.** That's correct, yes.

7 **Q.** And that allowed Duke Energy and Progress Energy to
8 phase their construction and put in their NOx controls first
9 and their sulfur dioxide controls second; is that correct?

10 **A.** Yes, they did. Yes.

11 **Q.** And if TVA is required to comply with what you consider
12 to be the equivalent cap by January 1st, 2013, TVA would not
13 have the opportunity to first put on NOx controls and then
14 separately put on SO2 scrubber controls afterwards; is that
15 correct?

16 **A.** Well, there's nothing about the caps to prevent you from
17 doing that. You know, there's nothing about the caps that
18 prevents TVA from installing SCRs first and then putting in
19 the scrubbers.

20 **Q.** But the fact of the matter is that the Clean Smokestacks
21 Act allowed Duke and Progress five years, from 2002 to 2007,
22 to work on their NOx controls, and then another five years
23 after that in order to put on their sulfur dioxide controls
24 to meet the final cap; is that correct?

25 **A.** Well, it is true that there was -- the dates are -- the

1 dates are in the record, so it's a matter of history.

2 Q. In addition to determining what you believe is an
3 appropriate cap for Tennessee Valley Authority, you also
4 estimated what you thought would be the cost, the capital and
5 operating and maintenance costs to TVA of complying with that
6 cap, correct?

7 A. That's correct, yes.

8 Q. And you had estimated the total capital cost of a
9 retrofit program to build these controls would be about \$3
10 billion in 2006; is that correct?

11 A. Yeah. That's the number that was in my initial expert
12 report, correct. Yes.

13 Q. But that was not intended to be a precise estimate, was
14 it?

15 A. No, it wasn't.

16 Q. You didn't give any man-hour calculations or materials
17 costs, back-up calculations, did you?

18 A. I provided -- the backup I did provide is that I used
19 algorithms that USEPA uses, and they're not intended to be --
20 as I state, explicitly state in my expert report, it's not
21 intended to be a detailed and precise estimate, in that prior
22 to undertaking such a program, you get better estimates doing
23 more detailed engineering studies.

24 Q. And you acknowledge that the cost estimation approach
25 you used resulting in a \$3 billion capital cost estimate has

1 an uncertainty range of minus 50 percent to plus 100 percent;
2 is that correct?

3 **A.** Well, according to -- according to, yeah, that approach.
4 That's the outside range, in general.

5 **Q.** So the actual capital cost to TVA could be 100 percent
6 more than your \$3 billion estimate.

7 **A.** Potentially, but unlikely. I mean, your own estimates
8 show that it's less. It's less than double my estimate. So,
9 you know...

10 And based upon reviewing Mr. Scott's estimates, as I
11 showed yesterday, the program that would get TVA to the CSA
12 equivalent caps, if you take out -- if you take out the
13 Widows Creek 1 through 6 -- if you don't scrub Widows Creek 1
14 through 6, you don't scrub Johnsonville, which you don't need
15 to do, necessarily, to get there if you reduce emissions at
16 Paradise 1 and 2, Widows Creek 7 and you're getting .15 pound
17 per million BTU on all the new scrubbers, which is what
18 you're doing on Paradise 3, you'll get under the cap and you
19 won't need to put scrubbers at Johnsonville or Widows Creek 1
20 through 6.

21 Now, if you do that, you take those scrubbers out and
22 you use Mr. Scott's estimate, whose I imagine you believe is
23 a good estimate, you're down to \$4.2 billion, roughly, as I
24 put in my supplemental expert report.

25 So, as I said, \$3 billion or \$5 billion dollars. I was

1 never intending that \$3 billion number to be a precise
2 estimate.

3 Q. You talked yesterday about what we'll call, quote,
4 reasonable emission rates, unquote. Is that correct?

5 A. Yes.

6 Q. Duke Energy's plants in North Carolina are not operating
7 at or better than these, quote, unquote, reasonable emission
8 rates for sulfur dioxide today, are they?

9 A. No, they're not. They're on a plan to get there.

10 Q. And they never have, have they?

11 A. No, they haven't. That's why there was a Clean
12 Smokestacks Act, to get them there.

13 Q. Progress Energy's plants in North Carolina are not
14 operating at emission rates superior to this, quote, unquote,
15 reasonable emission rate for sulfur dioxide, are they?

16 A. No, they're not, and that's why there was an act to get
17 them there.

18 Q. Have you done any calculations of any other utilities in
19 The southeastern United States to indicate that they are
20 operating at emission rates better than the, quote, unquote,
21 reasonable emission rate for sulfur dioxide that you
22 calculated?

23 A. I have not calculated other utilities in the Southeast.
24 I have -- I do work with the State of Illinois that has a lot
25 of coal-fired plants, and they are on a plan to get their

1 plants at levels that are even lower, lower than we're
2 talking about here.

3 But Southern Company certainly has a plan to -- Southern
4 Company certainly has a plan to get their plants down to
5 pretty low levels, and they're adding a lot of scrubbers in
6 order to do that.

7 **Q.** Would that plan likely be based on assumptions that
8 disappeared last Friday?

9 **A.** No, because -- because those assumptions, they are
10 all -- all of those scrubbers are subject to state rules, so
11 those -- Georgia actually is requiring their -- the State of
12 Georgia is requiring Southern Company to put in all those
13 scrubbers.

14 **Q.** But currently you don't have any information that any of
15 Southern Company's facilities in Georgia, its Georgia system,
16 is operating at better than the, quote, unquote, reasonable
17 emission rates you specified; is that correct?

18 **A.** No. But I imagine they're going to probably get down
19 close to it.

20 **Q.** You may well imagine that, but currently they're not,
21 are they?

22 **A.** Currently they're probably not because not all their
23 scrubbers are started up.

24 **Q.** You do not have any information that any utility system
25 in the state of Alabama is currently operating at better than

1 the, quote, unquote, reasonable emission rates you have
2 determined for sulfur dioxide; is that correct?

3 **A.** That is correct, and -- but at no time did I ever say
4 that utilities in the state of Alabama were operating at
5 reasonable levels. They probably ought to get them down.

6 **Q.** You have no information that any utility system in the
7 state of Mississippi is operating at better than the, quote,
8 unquote, reasonable emission rates you have found for sulfur
9 dioxide; is that correct?

10 **A.** Again, I'd say again, I don't have that information. I
11 imagine they are in excess of the reasonable emission rates,
12 and hopefully they will -- hopefully, something will happen
13 that will cause them to get it down, but at no point have I
14 ever said that they currently have reasonable emission rates.

15 **Q.** You don't have any information, do you, sir, that any
16 utility system in the state of Arkansas is operating at
17 better than the, quote, unquote, reasonable emission rates
18 for sulfur dioxide that you have specified; is that correct?

19 **A.** Again, my answer is that I don't have information, but
20 I've never said that their emission rates are reasonable.

21 **Q.** And you have no information that shows that any utility
22 in the state of Kentucky, any Kentucky utility system, is
23 operating at better than the, quote, unquote, reasonable
24 emission rates you have specified; is that correct?

25 **A.** No, I haven't analyzed the Kentucky utility system.

1 Q. You have no information about Virginia either, do you?

2 A. No. No, I don't -- I would not say necessarily no
3 information. I have incomplete information on Virginia, so I
4 have not completely analyzed Virginia.

5 Q. How about South Carolina?

6 A. I haven't analyzed South Carolina either.

7 Q. The last thing I would like to turn to, sir, is your
8 estimated projections for Tennessee Valley Authority's sulfur
9 dioxide emissions in the year 2013.

10 **THE COURT:** All right. This, I think, is a good
11 point for a midmorning break, so let's have 15 minutes.

12 **(Recess.)**

13 * * * * *

14 **THE COURT:** All right. You may proceed,
15 Mr. Lancaster.

16 **MR. LANCASTER:** Thank you, Your Honor.

17 **BY MR. LANCASTER:**

18 Q. Dr. Staudt, I have one last line of questioning I'd like
19 to cover with you, and that relates to your estimated
20 projections of TVA's 2013 emissions, which I believe you call
21 your 2013 base case; is that correct?

22 A. Yes.

23 Q. And that is not an estimation of current emissions, is
24 it? That is an estimation of expected 2013 emissions; is
25 that correct?

1 **A.** Well, what it is, is we took -- it's intended to show
2 equipment that is installed and operating and looking at what
3 that would be in 2013. So that's how we -- you know, that
4 way we could look at what the -- and it doesn't include
5 interim measures, such as some of the fuel switching that
6 might happen before you put a -- ultimately put a scrubber
7 on.

8 So that's why I think I testified in my deposition that
9 we used, for the unscrubbed units, the emissions, SO₂
10 emissions rates for 2005, because at that time I did not have
11 information on what TVA's fuel purchasing was going to be,
12 because, as you recall, TVA -- TVA kept its plan on the
13 privileged log at the time this was prepared.

14 **Q.** You projected that in calendar year 2013, TVA will have
15 a total of about 449,000 tons per year of sulfur dioxide
16 emission on its coal-fired power plant system, correct?

17 **A.** I put-- I projected in the 2013 base case 449,000. So
18 that's what the 2013 base case is.

19 **Q.** Correct.

20 **A.** Assuming -- again, assuming the assumptions -- you know,
21 you have to make some assumptions. So, and the assumptions
22 we assumed, existing and expected equipment, and, today, all
23 of the equipment that we assumed is what -- to be installed
24 and operating today is what is installed and operating.

25 **Q.** And your estimation or projection of TVA's 2013 total

1 system-wide sulfur dioxide emissions is almost exactly equal
2 to TVA's total system-wide sulfur dioxide emissions for
3 calendar year 2006, which were about 452,000 tons, correct?

4 **A.** If that's what they were, then that's what they were.
5 And that's about what they are. So it's pretty close.

6 **Q.** So, in other words, your prediction is that TVA will
7 make no reductions in its sulfur dioxide emissions between
8 2006 and 2013?

9 **A.** I hope that they do. And as we've seen since this case
10 has been initiated, they, you know -- TVA has, and I think
11 that's good.

12 Just one question I do have, if it's -- I don't know if
13 this is permissible. At some point, I'd like to clarify some
14 answers I gave to some previous testimony.

15 **Q.** Well, Mr. Goodstein will have an opportunity on redirect
16 to ask you questions.

17 But just to be clear, your projection, your 2013 base
18 case projection, is that TVA will make no reductions in its
19 sulfur dioxide emissions between 2006 and 2013. Isn't that
20 correct?

21 **A.** Could you restate it? I want to make sure that I'm
22 answering the question.

23 **Q.** You have projected a 2013 base case sulfur dioxide
24 emissions level for TVA's system of about 449,000 tons; is
25 that correct?

1 **A.** That's what I project in the base -- the base case. The
2 base case estimate is that.

3 **Q.** And that's right about where TVA was in 2006; is that
4 correct?

5 **A.** That's correct.

6 **Q.** So your projection is that TVA will make no reductions
7 in sulfur dioxide emissions on its system between 2006 and
8 2013; is that correct?

9 **A.** Well, this -- again, this is a base case projection
10 based upon assumptions that we made at the time, and those
11 assumptions have largely been held up, particularly with
12 regard to scrubbers.

13 I am glad to see -- I do -- as I've testified, I do
14 anticipate that, you know, the Bull Run scrubber is up,
15 you'll be running it and get lower emissions, and if and when
16 Kingston is completed, get emissions, and 2013 will look
17 better than this.

18 So, but it's still going to be well above, even by Mr.
19 Scott's estimates. You're still going to be well above
20 reasonable emission levels, even taking out the growth
21 assumptions that you've talked about.

22 So even by Mr. Scott's estimate and accommodating for
23 growth, you're still going to be well above reasonable
24 emissions levels.

25 **Q.** Let's talk about the Bull Run scrubber. One of your

1 assumptions in projecting such high 2013 sulfur dioxide
2 emission levels is that TVA's Bull Run plant will be
3 operating in 2013 as it is currently equipped; is that
4 correct?

5 A. For the 2013 base case, it assumes that the Bull Run --
6 Bull Run continues to operate.

7 2013 base case was made -- let me -- for the benefit of
8 the Court, the 2013 base case was made in early 2006 when
9 Bull Run was only at the very earliest stages of
10 construction. They basically had just broken ground.
11 Kingston was not under construction yet. So, as a result, we
12 had little reason -- we had -- we had to make assumptions
13 about what scrubbers we had confidence were going to be up
14 and running, and we did not include Bull Run for that reason,
15 because it was -- there just wasn't enough information to
16 convince us that it would be up and running, either at the
17 time of the trial or -- you know, hopefully -- hopefully up
18 and running by 2013.

19 Q. Your 2013 base case emissions projections for TVA on
20 sulfur dioxide, an assumption of those is that in 2013 the
21 Bull Run plant will not be operating with a scrubber. Is
22 that correct?

23 A. The 2013 base case assumes that it does not include a
24 scrubber, that's right.

25 Q. But you know there's a scrubber under construction at

1 Bull Run, don't you?

2 A. Yes, I do.

3 Q. You've seen it, correct?

4 A. Well, I've seen the scrubber under construction. That's
5 right.

6 Q. And when you gave your deposition over a year ago, at
7 that time you estimated the Bull Run scrubber was in the
8 range of 50 percent complete, correct?

9 A. That was a guess. I, you know -- I really -- you know,
10 I was -- at best, I could just guess at it.

11 Q. And if I understood your testimony correctly yesterday,
12 you indicated that significant progress on that construction
13 had been made since this lawsuit was filed.

14 A. Yes.

15 Q. And you're aware that the scrubber at Bull Run is
16 essentially complete; is that correct?

17 A. It's close to completion. That's my understanding.
18 It's my understanding it will be started up in a few months.

19 Q. And you're aware that TVA is spending on the order of
20 nearly \$300 million to build the Bull Run scrubber, correct?

21 A. That sounds about right.

22 Q. And after TVA has spent all the money to install the
scrubber at Bull Run, you would expect TVA to actually
23 operate the scrubber, wouldn't you?

25 A. I would expect you could save some money on some coal.

1 **Q.** There would be good reasons to operate the scrubber by
2 the fuel cost savings you described yesterday.

3 **A.** That's right.

4 **Q.** So if the Bull Run scrubber is, in fact, completed, it
5 is -- you would also expect that it would be operating,
6 correct?

7 **A.** Yes, and -- yeah, that's true. And what this does, this
8 proves that TVA can build these scrubbers. So I think
9 it's -- as I discussed, it's -- it helps show that, properly
10 motivated, TVA will install this equipment and get -- and get
11 things started up and reduce their emissions.

12 **Q.** If you will look at Plaintiff's Exhibit 54, which is on
13 the screen.

14 Based on your assumption that the Bull Run plant's
15 emissions will be unscrubbed in 2013, you projected 33,851
16 tons per year of sulfur dioxide emissions for Bull Run,
17 correct?

18 **A.** Yes, that's correct.

19 **Q.** But you project that if Bull Run's emissions are
20 scrubbed in 2013, the sulfur dioxide emissions will be
21 lowered to 4,341 tons, correct?

22 **A.** That's correct, yes.

23 **Q.** So if it turns out that Bull Run is operating with a
24 scrubber in 2013, your base case projection for Bull Run 2013
25 sulfur dioxide emissions is on the order of 30,000 tons high;

1 correct?

2 A. Well, the base case estimate would be -- it doesn't mean
3 that the base case estimate is high. The base case estimate,
4 what that means, that's developed for a specific purpose,
5 okay, to try to -- and similar to the SAMI study, you
6 identify -- the TVA apparently was a participant in -- but
7 you identify what's installed and operating, and then you
8 look at -- going forward, you do scenarios to see what might
9 happen under these scenarios and what the benefits would be.

10 So it's not -- it's not -- it is what it is. It's a
11 base case scenario and it -- and in the event that, you
12 know -- in the event Bull Run is up and scrubbing in 2013, as
13 we all hope and expect it will be, that actually -- that
14 actually gets TVA closer to where I believe they ought to be.
15 So that's good.

16 Q. If TVA is operating a scrubber at its Bull Run plant in
17 the year 2013, then, in the real world, TVA's emissions from
18 that plant of sulfur dioxide will be about 30,000 tons lower
19 than what you projected in your 2013 base case; is that
20 correct?

21 A. Roughly, yes. And in the real world -- actually, I hope
22 that TVA's actual emissions total are even lower, but in the
23 real world, that also means TVA is -- the incremental amount
24 of effort necessary to get to reasonable emissions levels is
25 that much less, so you're that much closer.

1 Q. Another of your assumptions -- in projecting the 2013
2 base case emissions for TVA, another of your assumptions is
3 that TVA's Kingston plant will be operating in 2013 as it is
4 currently equipped, correct?

5 A. Kingston, yes; that's correct.

6 Q. In other words, without a scrubber; is that correct?

7 A. That's right. And since there was no construction going
8 on in 2006, that was a pretty good assumption to make. And
9 since it isn't operating today, it's still a pretty good
10 assumption to make.

11 Q. You've been to TVA's Kingston plant, too, haven't you?

12 A. Yes, I have.

13 Q. And you know that there's a scrubber under construction
14 at TVA's Kingston plant. Is that correct?

15 A. Yes, I do.

16 Q. And you know that TVA is spending hundreds of millions
17 of dollars on Kingston scrubbers; is that correct?

18 A. I imagine that's about the right amount of money.

19 Q. And in your opinion, the Kingston scrubber will most
20 likely be -- construction will be completed by 2013, correct?

21 A. I would hope so, but, you know, one of the things that
22 happened on Friday is CAIR went away, and depending upon how
23 much money you've got left to the put into that scrubber to
24 complete it versus -- that may -- that may factor in to
25 decision to postpone or delay, you know, completion of it.

1 So I can say I hope you can have it done. I expect, if
2 you continue as you have since the initiation of this case,
3 you should be on target to complete it by then.

4 However, without a -- without a firm -- I imagine you've
5 still got a lot of money left to spend on Kingston. Without
6 a firm, compelling reason to complete it, there may -- there
7 may be a tendency, in light of CAIR being vacated, to say,
8 Well -- just like all these other scrubbers, as we've
9 testified earlier, people might say, Well, let's just slow it
10 down, see what happens, you know, or delay it.

11 **Q.** In your opinion, TVA can complete the scrubbers, the
12 Kingston scrubbers for all nine units, before 2013, correct?

13 **A.** Yes. Yes.

14 **Q.** And if TVA does complete the construction --

15 I'm sorry?

16 Oh, I'm sorry. I thought Your Honor said something.

17 **THE COURT:** No.

18 **BY MR. LANCASTER:**

19 **Q.** If TVA does complete the construction of the Kingston
20 scrubber before 2013, you would expect that the scrubbers
21 would be operational on all nine units in 2013, correct?

22 **A.** Yeah. You can save money on coal.

23 **Q.** And based on your assumption that Kingston plant's
24 emissions will be unscrubbed in 2013, you projected over
25 62,000 tons per year of sulfur dioxide emissions for

1 Kingston, correct?

2 A. Yes, according to this.

3 Q. But you project that if Kingston's emissions are
4 scrubbed in 2013, the sulfur dioxide emissions will be more
5 like 8,400 tons, correct?

6 A. That's correct, yes.

7 Q. So if Kingston plant is operating with scrubbers for its
8 nine units in the year 2013, its emissions, in the real
9 world, are likely to be on the order of 50,000 tons lower
10 than what you projected in your 2013 base case; is that
11 correct?

12 A. Yes, that would be true. And you know what? Again,
13 that makes it -- that makes it that much easier for TVA to
14 get closer to the -- to get to the CSA equivalent case,
15 because you're that much closer; that work is in the bag, so
16 to speak, if I can characterize what you're saying, and
17 you're going to -- you know, all you need to do is close the
18 difference.

19 Q. I want to talk now about the Paradise plant. The
20 scrubbers at units 1 and 2 of TVA's Paradise plant in
21 Kentucky, TVA built those scrubbers 20 or more years ago,
22 correct?

23 A. Yes. Yes, they did.

24 Q. Now, the scrubber that TVA recently started up at
25 Paradise unit 3 wasn't built 20 or more years ago, was it?

1 **A.** No.

2 **Q.** Yet, in making your 2013 base case projections, you
3 assumed that the brand new scrubber at Paradise unit 3 would
4 operate at the same removal efficiencies as the 1980
5 scrubbers at Paradise unit 1 and 2, didn't you?

6 **A.** Yes, I did. But also, in my report I said I thought it
7 was likely that it could, indeed, operate at .15.

8 I also said that it would -- it would -- it would make
9 getting to the base -- getting to the CSA equivalent case
10 easier, okay. And as I testified yesterday, the difference
11 to the base case estimate is only about 3 percent.

12 **Q.** And in terms of tons, it's 14,000 tons; is that correct?

13 **A.** 14,000 tons, that's correct.

14 **Q.** So if the Court determines that the Kingston -- excuse
15 me -- the Paradise plant is likely to be operating with a
16 scrubber at a .15 emission rate in the year 2013, then your
17 base case estimates of the Paradise plant's sulfur dioxide
18 emissions are on the order of 14,000; is that correct?

19 **A.** Yeah. The effect of that assumption is about 14,000,
20 the difference between .15 and .6 pound per million BTU.

21 And what I'd also like to bring to your attention is
22 that I underestimated NOx because -- because intrinsic to --
23 I assumed that the Clean Air Interstate Rule would be in
24 place, as did Mr. Scott in his projections, as does TVA --
25 did TVA, and as we all know, that rule was vacated and the

1 requirement to operate NOx controls on an annual basis
2 disappeared on Friday, so this 115,000 tons number is way
3 too -- for NOx, is way too low for the base case.

4 Q. Thank you for bringing that to my attention, sir.

5 A. Sure.

6 MR. LANCASTER: Your Honor, may I approach the map
7 to ask my last couple of questions?

8 THE COURT: Sure.

9 BY MR. LANCASTER:

10 Q. Do you see the Cumberland plant, Dr. Staudt?

11 A. Yes, I do.

12 Q. On the screen, could you circle your base case
13 projections of Cumberland's sulfur dioxide emissions?

14 A. (Indicating).

15 Q. And it's obscured a little bit, but your projections are
16 that Cumberland's sulfur dioxide emissions will be 20,396
17 tons per year, either with or without any injunction from
18 this Court; is that correct?

19 A. Well, the assumption is that -- let me -- the assumption
20 is that, in any event, that Cumberland has scrubbers
21 installed and those scrubbers would continue to be operated
22 as they currently are.

23 Q. In other words, Cumberland will be operating at or
24 better than the reasonable emission rates that you estimated;
25 is that correct?

1 A. SO₂ would be close to it. I'd have to examine what the
2 specific emission rates would be, yes, but I would say it's
3 likely that or better.

4 Q. Let's look at the Bull Run plant. If the Court
5 determines that the Bull Run plant is likely to be operating
6 with a scrubber in the year 2013, that would mean that in
7 2013 the Bull Run plant will be operating at or better than
8 what you have determined to be reasonable emission rates; is
9 that correct?

10 A. Well, the Bull Run itself, Bull Run plant itself -- I
11 mean, you're just talking SO₂?

12 Q. Yes, sir.

13 A. You're just talking SO₂. It should be.

14 Q. And if the Court determines that the Kingston plant is
15 likely to be operating with a scrubber in the year 2013, that
16 will mean that the Kingston plant is operating at or better
17 than what you have estimated are reasonable emission rates
18 for sulfur dioxide; is that correct?

19 A. I would hope so. I would hope they're operating at or
20 better than.

21 Q. They will be if they are operating with scrubbers; is
22 that correct?

23 A. Yeah. If they're properly operating, yes, I would hope
24 so.

25 Q. The John Sevier plant, if the Court determines that it's

1 likely that TVA will have a scrubber in place at the John
2 Sevier plant in the year 2013, then the John Sevier plant
3 will be operating at or better than what you consider to be
4 reasonable emission rates for sulfur dioxide, correct?

5 A. Well, if the Court decides that, I think at this point I
6 would say John Sevier is far less certain than Bull Run.

7 Q. And I began my question with an "if." I'm allowed to
8 ask an expert witness a hypothetical.

9 If the Court determines that it is likely that the John
10 Sevier plant will be operating with a scrubber in the year
11 2013, then that will mean that it is likely that the John
12 Sevier plant will be operating at or better than what you
13 have determined are reasonable sulfur dioxide emission rates,
14 correct?

15 A. Well, first, I want to clarify. I don't know if there's
16 special legal meaning when you say, "if the Court determines
17 it's likely."

18 I will say that if the John Sevier plant is operating
19 with a scrubber in operation, as we all hope it will be, at
20 .15 pounds per million BTU, if that is, indeed, happening, it
21 will be at or below the reasonable emissions.

22 Q. That's what I was after, sir.

23 And in that case, if John Sevier, Bull Run and Kingston
24 all three operate with a scrubber, then all three of those
25 plants will operate at or better than what you consider to be

1 reasonable emission rates; is that correct?

2 A. That would be correct. But the rest of the system --
3 you've got to look at the rest of the system, too, because
4 they all contribute.

5 Q. But as to those three plants, that would be correct; is
6 that right?

7 A. As we say, yeah, but those three plants, if they're
8 operating at .15 pound per million BTU, they will be at or
9 below a reasonable emission -- they'll be at a reasonable
10 emission level, yes.

11 **MR. LANCASTER:** Thank you, Dr. Staudt.

12 I have no more questions, Your Honor.

13 **THE COURT:** Any redirect?

14 **MR. GOODSTEIN:** Thank you, Your Honor. Some
15 redirect.

16 **REDIRECT EXAMINATION**

17 **BY MR. GOODSTEIN:**

18 Q. Dr. Staudt, just following up on this line of
19 questioning, what portion of your system-wide cap is
20 appropriately apportioned to the eastern plants and TVA
21 system?

22 **MR. LANCASTER:** Your Honor, I object. This is the
23 same testimony -- let me start over.

24 I object. This is the same testimony that the
25 Court sustained an objection to yesterday, the effort to make

1 an apportionment of cap levels that was not disclosed in the
2 expert report.

3 **THE COURT:** Yes. I sustain the objection.

4 **THE WITNESS:** Would it be possible for me to
5 clarify some previous answers?

6 **MR. GOODSTEIN:** Yes. If you have something to
7 clarify about your prior testimony, please do so.

8 **THE WITNESS:** Mr. Lancaster asked me earlier about
9 whether or not I examined emissions in different states to
10 see if they were at reasonable levels. I did not look at the
11 entire state of Alabama or the entire state of Kentucky, and
12 that's what I was understanding Mr. Lancaster to be asking.

13 What I did do is look at TVA's plants in each of
14 the three states it operates at, and if you look at TVA in
15 Alabama or TVA in Kentucky, they do -- they do operate in
16 excess of the reasonable emission rates that I described.

17 So I apologize if there was any confusion for that.
18 But I did not examine the entire state of Kentucky or the
19 entire state of Alabama or all the utilities in Alabama or
20 the utilities in Kentucky.

21 **MR. GOODSTEIN:** Your Honor, Mr. Lancaster examined
22 Dr. Staudt on the individual emissions expected from
23 individual plants, and I believe he's opened the door to this
24 testimony. He's examined the witness about dividing up the
25 emissions of individual plants.

1 We were talking about a system-wide cap yesterday,
2 but I think he's opened the door on cross-examination to talk
3 about how that cap would be apportioned among the plants in
4 the system based on his cross-examination questions.

5 **MR. LANCASTER:** Your Honor, I would simply submit
6 that I did not open any door. I simply asked Dr. Staudt
7 whether certain plants were operating at reasonable emission
8 rates, and he didn't say that they are.

9 **THE COURT:** I think the question has been
10 adequately addressed and explored on both sides.

11 **MR. GOODSTEIN:** All right.

12 **THE COURT:** So I'll sustain the objection.

13 **MR. GOODSTEIN:** Thank you, Your Honor.

14 **BY MR. GOODSTEIN:**

15 **Q.** So, Dr. Staudt, we were listening to your testimony
16 about the benefits of caps versus a plan. Can you expound on
17 that and explain to us what the benefit of the cap is?

18 **A.** Okay.

19 **Q.** For not only for projects that need to be completed, but
20 also projects that are under construction today --

21 **A.** Yes.

22 **Q.** -- in the real world. What's the advantage of a cap in
23 the real world versus a plan?

24 **A.** Okay. Thank you.

25 Yes. A cap -- a cap -- a legally enforceable cap

1 establishes a requirement for the utility to reduce its
2 emissions. With a cap, that provides much greater certainty
3 that the emission reductions will actually occur. It
4 provides a specific timeline for the emissions reductions to
5 occur by, and so it ensures that the reductions will occur by
6 a reasonable time that's determined by the time and the
7 amount of the cap.

8 Absent -- and what that does is, for the people who are
9 subject to the cap -- in this case it would be TVA -- it
10 ensures that TVA would keep their current projects -- and I
11 am glad to see that they have these -- they've made progress
12 on these projects at Bull Run and Kingston, and hope to see
13 more happening at John Sevier and other plants. But it's --
14 it's very -- a cap makes sure that those projects stay on
15 track. A cap -- so -- and it also makes sure that once that
16 equipment is operated, that indeed -- installed, that indeed
17 it will be operated properly and maintained properly. It
18 also provides motivation to get additional reductions.

19 Absent a cap, if we're relying on a plan, a plan that is
20 not a firm commitment, not a legal obligation, a plan that
21 may be subject to change, a plan that is premised on a
22 federal program that doesn't exist anymore, the plan provides
23 very little uncertainty -- or excuse me -- very little
24 certainty and a great deal of uncertainty.

25 A plan can be changed. And TVA has changed its plan in

1 the -- plans in the past. They basically postponed the
2 Colbert scrubber. And, in fact, TVA's own characterization
3 is an extended deferral period for that scrubber.

4 In a 2006 10-Q to the Securities Exchange Commission,
5 they wrote off \$17 million in engineering. That's a lot of
6 engineering to write off for a scrubber if you really plan to
7 build it.

8 So there is a great deal of uncertainty about TVA's
9 plan, particularly in light of what happened Friday. There
10 was a lot of uncertainty to begin with, but it got even more
11 uncertain on Friday.

12 Q. And what about the regular operational maintenance of
13 controls that are installed? How does a cap affect that?

14 A. Well, a cap ensures that these controls are, indeed,
15 operated. There are, for example -- there are -- sometimes a
16 scrubber might be shut down or bypassed or something due to,
17 for whatever reason, startup or something like that. But it
18 also provides a lot of motivation to make sure that those
19 times are minimized and the scrubber is operated as much as
20 possible.

21 It also -- the cap -- one thing we see with NOx is that
22 the existence of SCRs doesn't mean that you're going to run
23 the SCRs. TVA runs its SCRs during the ozone season, just as
24 Duke and Progress only ran their SCRs during the ozone season
25 until there was a requirement to run the SCRs year round and

1 provide the benefit of those SCRs on an annual basis.

2 So a cap ensures that the equipment is not only
3 installed on time, that it continues to be operated, and it
4 makes sure that the utility is diligent in reducing its
5 emissions.

6 A plan -- a plan -- it's too uncertain, and --

7 **MR. GOODSTEIN:** If I may approach, Your Honor, I
8 would like to put an exhibit up on the easel.

9 **BY MR. GOODSTEIN:**

10 Q. Dr. Staudt, you were asked earlier by Mr. Lancaster
11 about this photograph that was taken the day you were out at
12 Widows Creek.

13 Is the scrubber on Widows Creek No. 8 operational in
14 that photograph?

15 A. No, it is not. If the scrubber at Widows Creek No. 8
16 were operational, we would not be seeing -- we would be
17 seeing a white, puffy cloud similar to on the stack of Widows
18 Creek No. 7.

19 At Widows Creek No. 8, they do not have dedicated
20 particulate removal -- at Widows Creek No. 8, they don't have
21 dedicated particulate removal equipment, so they rely on that
22 scrubber to remove primary particles, and so if you see that
23 coming out the stack, you know that the scrubber isn't
24 operating.

25 Q. So this is an example of a period of time where there's

1 a piece of equipment on a plant that's not being operated?

2 A. That's true. And having a cap would provide a lot of
3 motivation to minimize periods like this. Absent a cap,
4 there isn't the same amount of motivation.

5 Q. And would the emission caps that you developed, would
6 they in any way discourage TVA from completing the projects
7 currently under construction and operating and maintaining
8 those controls out into the future?

9 A. No. On the contrary, the cap -- there's nothing about
10 the caps that upsets TVA's plan or what -- the projects TVA
11 has on the way, rather. Nothing upsets the Kingston or Bull
12 Run scrubber. On the contrary, number one, it provides
13 motivation to make sure that those projects stay on track;
14 and, number two, it creates motivation that once those
15 scrubbers are installed and operating that they continue to
16 operate as much as possible and that they also are, you know,
17 maintained well.

18 So that's an important characteristic of -- those are
19 all important functions of a power plant in trying to
20 maintain their emissions level, and a cap makes that --
21 creates that motivation for the utility.

22 I'd also like to add that the advantage of a cap to a
23 utility, first of all, what it does is, it provides the
24 utility the opportunity to find the best way to meet those
25 emissions levels.

1 **THE COURT:** I think I've got that point, so let's
2 move on.

3 **MR. GOODSTEIN:** Okay. Thank you, Your Honor.

4 **BY MR. GOODSTEIN:**

5 **Q.** And in addition to the construction projects that were
6 mentioned by Mr. Lancaster, are there other projects or other
7 measures that are going to be required by TVA to achieve
8 reasonable emission rates by 2013?

9 In addition to the ones that are under construction
10 right now, what other projects did you identify as potential
11 projects that they would need to be completed by 2013 in
12 order to achieve the reasonable emissions levels?

13 **A.** I identify the projects in my report.

14 **Q.** Yeah. Could you take a look and refer to the map and --

15 **A.** Okay.

16 **THE COURT:** Is this repeated information we already
17 have in the record and have already discussed, or am I
18 missing something?

19 **MR. GOODSTEIN:** I'm sorry, Your Honor. I don't
20 intend it to be. I was just trying to respond to what's
21 already been identified on this chart as an incomplete list
22 of the types of things that TVA will have to do to meet
23 compliance with the caps.

24 I certainly don't want to go over ground we've
25 already covered, Your Honor. I was just going to have

1 Dr. Staudt point out which plants on the figure are ones that
2 are going to require additional controls in order for TVA to
3 achieve reasonable emission rates by 2013.

4 **THE COURT:** All right. Let's do it again, quickly.

5 **THE WITNESS:** Okay.

6 **MR. GOODSTEIN:** Thank you, Your Honor.

7 **THE WITNESS:** In addition to the scrubbers at John
8 Sevier, Bull Run and Kingston, there is -- there's already a
9 scrubber that's been announced at Colbert, but it's been
10 delayed, as I discussed. That would need to be completed.
11 Allen would need to be scrubbed. Wouldn't -- as I just
12 testified earlier, it's not necessary to scrub Johnsonville,
13 Shawnee -- and I'm not going to talk about the particulars of
14 TVA's plan, but Gallatin. So those are the scrubbers that
15 would need to be installed.

16 And for SCRs, we would have -- we would have SCRs
17 installed at John Sevier, which apparently is in the plan. I
18 don't know if it's going -- if it's in the plan for 2013.
19 It's been announced. It's been announced, but it's unclear
20 when, if it's going to be by 2013.

21 We would have -- Gallatin would need to be equipped
22 with SCRs. And Johnsonville, Widows Creek 1 through 6, you
23 have, that's SNCR or some other approach to reduce NOx. And
24 wouldn't need to add SCRs to Colbert because they -- excuse
25 me -- you would need to add SCRs at Colbert, for Colbert's 1

1 through 4, but Allen already has SCRs. So you'd be looking
2 at some SCRs at Colbert, Shawnee, Gallatin. And those are
3 the things that are in addition to what's already been
4 announced and apparently is...

5 **MR. GOODSTEIN:** All right. Thank you, Dr. Staudt.

6 You can retake the stand.

7 **BY MR. GOODSTEIN:**

8 **Q.** You were asked, Dr. Staudt, whether -- why, or the
9 purpose of developing the base case and the control case of
10 estimates for 2013.

11 Do you recall being asked that on cross-examination?

12 **A.** Excuse me. Could you repeat the question, please?

13 **Q.** You were asked about the purpose of developing the base
14 case and the control case for 2013.

15 **A.** Yes, I recall.

16 **Q.** And you refer to a similar purpose as the SAMI study --

17 **A.** Yes.

18 **Q.** -- which we heard about earlier in the week.

19 **A.** That's correct, yes.

20 **Q.** Can you explain for us, please, what the reference was
21 to the SAMI study and why the method that you used and that's
22 being used by the State of North Carolina in this case,
23 estimating benefits of the caps, is similar to the method
24 that was employed in SAMI.

25 **A.** I'll probably -- I may mischaracterize exactly the words

1 that were used, but the hope was to -- let me start over
2 again.

3 We -- our base case represents a case where what is --
4 what is installed and operating now. Okay. So what's
5 installed and operating now. Then there's also this
6 on-the-way type of case that SAMI -- we didn't look at that
7 because what's on the way is sort of -- you know, we're not
8 sure what's on the way, frankly.

9 **Q.** Okay. What I'm asking specifically about is, for
10 purposes of your caps, there's an emission reduction
11 associated with your base case and control case.

12 **A.** Yes.

13 **Q.** And you provided those.

14 **A.** Yes.

15 **Q.** And those -- the differences in emissions between your
16 base case and your control case will result in some changes
17 in the levels of pollution that's going to be emitted from
18 TVA's power plants between these two scenarios.

19 **A.** Yes.

20 **Q.** And those reflect additional controls, right --

21 **A.** Yes.

22 **Q.** -- to achieve your caps?

23 **A.** And the idea is to make an estimate of what the benefit
24 would be between current conditions and the benefit of a cap.

25 Okay. The objective was not to be -- estimate what would

1 happen if -- because we didn't -- first of all, we didn't
2 even have TVA's plan. We couldn't even say, Well, what might
3 happen.

4 But what is installed and operating at this time versus
5 if this cap were imposed, we could quantify the amount of
6 emissions reduction, and then other people could testify
7 about what -- what the benefits of that reduction would be.

8 Now, to the extent that something that TVA does in the
9 interim helps to reduce their emissions is helpful, but it
10 also doesn't mean that those benefits go away. It means --
11 the benefits are still there. The total benefits are still
12 there. It just means that TVA is a little bit closer to
13 getting to where they need to be. It means that not only
14 have -- you know, if the difference in benefits is between
15 where TVA eventually is in 2013, and where we'd like them to
16 be is lower than the difference between the base case and
17 where we'd like them to be in 2013, there's still benefits in
18 reducing emissions. But there's also -- but what they also
19 do is reduce the incremental cost, okay, the incremental
20 amount of effort.

21 So everything that TVA does in the interim, as I said,
22 to add scrubbers at Kingston and Bull Run, and possibly John
23 Sevier, these are helpful and contribute to getting to that
24 end point.

25 **Q.** So based on your determination of current unreasonable

1 emission rates by TVA and then your calculation of a control
2 case to bring them into reasonable emission rates, do
3 those -- the emission delta that you calculated that's in the
4 record now, does that reflect the benefit of the caps?

5 **A.** Yes.

6 **Q.** Does that reflect the full benefit of the caps?

7 **A.** It reflects the full benefit of the caps between the
8 base case and the cap level, the control case.

9 **Q.** And if the base case had included projects that are not
10 currently operational but are on the way, then your
11 difference between your base case and your control case,
12 would that reflect the full benefit of the caps in the real
13 world --

14 **A.** No, it wouldn't.

15 **Q.** -- compared to current conditions?

16 **A.** No. No, they wouldn't, because those projects are a
17 means of getting to the caps. So they're an element of the
18 strategy to get to the caps.

19 And I was very consistent in my analysis that for all
20 the projects that -- the assumptions for the base case and
21 the assumptions for the control case, okay, they reflect
22 consistent projects. Okay. So to the extent that somebody
23 adds more scrubbers and reduces the emissions, that would
24 obviously reduce the amount -- the additional reduction that
25 needed to be achieved, but it contributes to that overall

1 benefit of the caps.

2 **THE COURT:** I think I'm hearing repetitious
3 testimony.

4 **MR. GOODSTEIN:** Okay, Your Honor. I'll move on.
5 I'll move on, Your Honor. Thank you very much.

6 **THE COURT:** Questions?

7 **MR. GOODSTEIN:** I'm sorry. I have a few more, Your
8 Honor. I have a few more other topics. I'm sorry.

9 **BY MR. GOODSTEIN:**

10 **Q.** You were asked about the Clean Smokestacks limits
11 earlier by Mr. Lancaster.

12 **A.** Yes.

13 **Q.** And I refer your attention to Plaintiff's Exhibit 93,
14 please. Should be in evidence.

15 You were asked whether there was an interim limit for
16 sulfur dioxide in the Clean Smokestacks program. Do you
17 recall those questions?

18 **A.** Yes.

19 **Q.** Now, having refreshed your recollection with this
20 summary from your report, is there a limit for sulfur dioxide
21 that kicks in for Duke and Progress prior to 2013?

22 **A.** Yes. I didn't know that I testified contrary to that.

23 **Q.** Okay. So it's your understanding that there is an
24 interim limit for both NOx and sulfur dioxide in the Clean
25 Smokestacks program?

1 A. That's correct, yes.

2 Q. So Duke and Progress were required to install sulfur
3 dioxide controls prior to the 2013 deadline?

4 A. That's correct. And they have.

5 Q. As indicated on Plaintiff's Exhibit 93.

6 A. And they have, to the tune of --

7 Q. Are you aware, Dr. Staudt, when TVA was on notice of the
8 Clean Smokestacks Act being passed in North Carolina?

9 A. Yes. In fact, they were specifically identified in the
10 act as another party that North Carolina should look to in
11 order to get additional reductions.

12 Q. So that was as of 2002?

13 A. So that was as of 2002, yes.

14 Q. Can you tell us, Dr. Staudt, the result of TVA only
15 running their SCRs for part of the year? Can you tell us
16 what the result from an emission standpoint is?

17 A. Well, what it means is that they're only controlling
18 their emissions from June -- for the five months of June
19 through September, and if they controlled it annually, that
20 would be an additional seven months. So for those units that
21 are equipped with SCR, their emissions would probably be --
22 annual emissions, if they operated annually, be cut in half
23 or more because of the annual operation. It would be
24 probably at least half of what -- half or less, rather, of
25 what they currently --

1 Q. They're currently just operating the SCRs during the
2 ozone season, May to September?

3 A. That's right, May to September. It's 153 days.

4 Q. With regard to the new unit that's under construction at
5 Cliffside, do you recall being asked about that on
6 cross-examination?

7 A. Yes, I do.

8 Q. Is that new unit being installed with modern controls?

9 A. Yes. Being a new unit, it has to be installed with best
10 available control technology. It has scrubbers -- it has a
11 scrubber. It has SCR. It even has a fabric filter, which is
12 an even better particulate control device than an ESP. So it
13 has essentially the best you can get with a coal-fired plant.

14 Q. And does TVA have plans to install any additional
15 coal-fired capacity on their system that you're aware of?

16 A. None that I'm aware of.

17 Q. So based on what's happening on the ground, are your
18 growth rates that you used from the IPM confirmed?

19 A. Yes. Yes. In fact, in North Carolina's comments to EPA
20 regarding the NOx SIP Call, they criticized -- they were --
21 they felt that their growth rates should have been higher and
22 NOx SIP Call was upheld, but in their comments, they showed
23 about a 36 percent growth rate over the '98 to 2007 period,
24 and, you know, that works out to be close to what I -- a
25 similar -- similar period of time, similar growth level to

1 what we see for the ten-year period that I estimated, roughly
2 from about 2012 to 2013.

3 Q. And you were asked about industrial sources. Are there
4 industrial sources in Tennessee?

5 A. Yes, there are.

6 Q. Are there industrial sources of these pollutants that
7 we've been discussing in Kentucky and Alabama?

8 A. Yes. Yes, there is.

9 Q. And are there industrial sources in North Carolina?

10 A. Yes, there are.

11 Q. Does that affect your conclusion in any way that TVA's
12 emission rates from their coal-fired power plants are
13 unreasonable?

14 A. No, it doesn't affect my opinion. And usually it's --
15 in terms of getting reductions in emissions, it's -- I talked
16 about the cost per ton of control yesterday. It is pretty
17 well established that utility power plants are the least
18 expensive way to get cost -- to get reductions of these
19 pollutants, particularly SO2.

20 Q. And you were asked about a comparison of TVA's current
21 emissions to historical emission rates with Duke and
22 Progress. Did you use historical emission rates for Duke and
23 Progress to determine the TVA reasonable emission rate that
24 you testified to? Did you use historical rates?

25 A. In my opinion, no, because historical rates --

1 historical emission rates for Duke and Progress by just --
2 were unreasonable, so it's -- and that was why the Clean
3 Smokestacks Act was created. So there is no point in using
4 them as a benchmark of anything, except to say, indeed, their
5 historical rates were unreasonable.

6 And just to be, you know, for somebody to be slightly
7 under Duke and Progress, somewhat under Duke and Progress,
8 doesn't make them -- their emission rates reasonable. So if
9 TVA's rates were lower than Duke and Progress, it doesn't
10 necessarily mean that TVA's rates were reasonable. They're
11 both unreasonable.

12 Q. You were asked about your deposition testimony and about
13 some prior testimony where you set the same level at the same
14 time when describing the -- what North Carolina's looking for
15 in this case as compared to the Clean Smokestacks equivalent.

16 Can you tell us what you meant by that?

17 A. Well, similar emission rates. Okay. And I used
18 output-based emission rates. So what I meant by that is --
19 and by an output-based emission rate, pounds of pollutant per
20 amount of electricity generated. And that's how I developed
21 the caps.

22 Q. And you were also asked whether or not an appropriate
23 measure of the trade-off for electric power was simply sulfur
24 dioxide versus megawatt hours.

25 My question is, are there other considerations

1 potentially on a coal-fired power plant and on a coal-fired
2 power plant system that you would want to consider in
3 determining a trade-off like that, for example, the site
4 location or the location of nearby receptors?

5 **A.** Well, as far as the location of nearby receptors, I'll
6 stay off of that because I think it probably makes sense, you
7 know, if -- from a -- as other people will talk about, the
8 closer you are, the more -- the closer you are to a site, the
9 more impact there is going to be, but other people can talk
10 about that. Certainly, that may be something that's factored
11 in, okay?

12 **Q.** Okay.

13 **A.** But I can't describe how it would be done in detail.

14 **Q.** And based on your experience, if a new power plant was
15 being sited at the location of the Bull Run plant, would
16 modern controls be required on such a plant at such a
17 location?

18 **A.** Well, I -- I don't know if a new power plant would be --
19 I'm not sure if you could get --

20 **Q.** You couldn't get it sited from --

21 **A.** I'm not sure if you could get it sited, but if it were
22 sited at Bull Run, you would definitely have to have a lot of
23 controls on that plant.

24 **Q.** And what about Kingston, based on your experience?

25 **A.** Same thing for Kingston, because they're all -- you

1 know, they're all close to Class 1 areas, so they --

2 **THE COURT:** Mr. Goodstein, you had all day
3 yesterday to address this witness.

4 **MR. GOODSTEIN:** Okay. I have no further questions,
5 Your Honor.

6 **THE COURT:** You're out of time. Five more minutes,
7 at the most.

8 **MR. GOODSTEIN:** I'll pass the witness, Your Honor.
9 I'm sorry for the delay.

10 **THE COURT:** Do you have any further questions?

11 **MR. LANCASTER:** I have no questions, Your Honor.

12 **THE COURT:** Dr. Staudt, that will complete your
13 testimony and you may be excused. Thank you, sir.

14 **THE WITNESS:** Thank you, Your Honor.

15 **MR. GOODSTEIN:** Your Honor, we'd like to call our
16 next witness, Neil Wheeler, please.

17 **NEIL JOSEPH MCCLAIN WHEELER,**
18 **being duly sworn, was examined and testified as follows:**

19 **DIRECT EXAMINATION**

20 **MR. GOODSTEIN:** Your Honor, if I may approach, we
21 have a set of exhibits for Mr. Wheeler.

22 **THE COURT:** All right, sir.

23 **BY MR. GOODSTEIN:**

24 **Q.** Good afternoon, Mr. Wheeler. Can you state your full
25 name for the record, please.

1 A. I'm sorry. I can't quite hear you.

2 Q. Can you state your full name for the record?

3 A. Yes. Neil Joseph McClain Wheeler.

4 Q. And how are you currently employed, Mr. Wheeler?

5 A. I am currently a senior vice president at Sonoma
6 Technology in Petaluma, California, and I direct the
7 atmospheric modeling and information systems programs there.

8 Q. Can you hear me okay? Yes?

9 A. Yes.

10 Q. All right. I'll try to speak into the microphone. I
11 apologize.

12 And what are your duties and responsibilities in your
13 current position at Sonoma Technologies?

14 A. As I said, I direct the atmospheric modeling program,
15 information systems programs. This includes using
16 photochemical models, meteorological models, emissions models
17 to do air quality analysis, and also directing the
18 operational systems of the company, including computer
19 systems, databases, and software development.

20 Q. And what has been your involvement in this case,
21 Mr. Wheeler?

22 What has been your involvement in this case?

23 A. I'm sorry. I'm having trouble hearing.

24 Q. Okay. What has been your involvement in this case?

25 A. In this case, we were asked by the North Carolina

1 Department of Justice to see if we could perform some
2 analyses with models to determine impacts from TVA coal-fired
3 power plants, as well as look at the potential benefits of
4 the controls sought by the State of North Carolina.

5 Q. And did you do that work with Mr. Chinkin, also at
6 Sonoma Technologies?

7 A. Yes, I did.

8 Q. Can you tell us a little bit about your firm and what
9 your experience is in doing air quality modeling and air
10 quality analysis?

11 A. Well, I guess it starts with my career. I started my
12 career as an Air Force officer.

13 **MR. FINE:** Your Honor -- I apologize for the
14 interruption, Mr. Wheeler -- I understood that we were going
15 to have a stipulation about Mr. Wheeler's expert credentials.
16 Might be able to speed this process up some.

17 **MR. GOODSTEIN:** Yes, we do have a stipulation, Your
18 Honor. I'm not going to belabor anything, but I need to
19 bring out the basic background of Mr. Wheeler's experience
20 with air quality modeling. Goes to the weight and his
21 testimony about the model and the results of the model. I
22 will certainly move it along.

23 **THE COURT:** You do have a stipulation of the
24 parties and Mr. Wheeler is an expert in the field.

25 **MR. GOODSTEIN:** Yes. So I'm just going to bring

1 out the highlights, Your Honor.

2 **MR. FINE:** Your Honor, I believe the stipulation is
3 that Mr. Wheeler is an expert in air quality analysis and
4 modeling.

5 **MR. GOODSTEIN:** That's correct. We appreciate that
6 stipulation, Your Honor.

7 **MR. FINE:** Thank you, Your Honor.

8 **THE COURT:** Thank you both.

9 **BY MR. GOODSTEIN:**

10 **Q.** All right. I'm sorry, Mr. Wheeler. If you could just
11 give us a brief overview of your background and experience in
12 air quality analysis and modeling.

13 **A.** Certainly. Just briefly, my initial work, from
14 graduating from the University of California, I was with the
15 United States Air Force. They sent me back to school to get
16 a second bachelor's degree in meteorology.

17 My first assignment out of school was at the North
18 American Air Defense Command, NORAD, in Cheyenne Mountain,
19 Colorado, where my duties include data analysis of
20 meteorological data, forecasting, and serving as an adviser
21 to the command director on environmental issues.

22 During that period, I attended the Air Force Graduate
23 School of Meteorology and took a 200-hour course on advanced
24 applications, which include analysis techniques and satellite
25 interpretation, as well as air quality dispersion modeling.

1 Q. All right, Mr. Wheeler, I'm sorry to interrupt you. I
2 just want to note for the record that your CV is in the books
3 for Mr. Wheeler as the first exhibit in that book numbered
4 427. So we're going to bring that up on the screen.

5 All right. Go ahead, Mr. Wheeler. I'm sorry.

6 A. Upon separation from the United States Air Force, I
7 returned to graduate school and received a master's degree in
8 natural science, with a physics concentration, and then was
9 hired at the California Air Resources Board in Sacramento,
10 California.

11 At the California Air Resources Board, which I worked at
12 for sixteen years, I started in data analysis and air quality
13 forecasting. That work involved daily forecasts as well as
14 determination of potential hazardous conditions for air
15 quality.

16 In the early years, I began experimenting with models
17 for air quality and meteorology. I was recruited by the
18 research division at the Air Resources Board to come to work
19 in their modeling group there, where I initially started in
20 modeling toxics and developing techniques for population
21 exposure.

22 I then --

23 Q. And you're talking about the California Air Resources
24 Board, just to make that clear.

25 A. Excuse me?

1 **Q.** California Air Resources Board.

2 **A.** California Air Resources Board. The California Air
3 Resources Board is the main air quality agency for the State
4 of California. At the time I joined, it was an independent
5 agency. It's now a part of CAL-EPA.

6 **Q.** And what is their role? California Air Resources Board,
7 what is their role?

8 **A.** My role initially was forecasting, but as I moved into
9 modeling, it became applying models for various reasons. In
10 the late '80s, we were developing models for state
11 implementation plans. And I worked up through the ranks
12 there and came to manage the control strategy modeling
13 section at the Air Resources Board.

14 **Q.** And then what did you do after that?

15 **A.** In 1996, I was recruited by the North Carolina
16 Supercomputing Center to head their modeling applications
17 group. I was chief of environmental applications, and there
18 I applied models for the Ozone Transport Assessment Group,
19 OTAG.

20 I also did modelings for the States of North Carolina,
21 Virginia and Texas, using the Urban Airshed Model. The work
22 also included applying some new models. We're developing at
23 North Carolina Supercomputing Center a new model called
24 NAQSIP, and that model was the prototype for the EPA's latest
25 model, CMAQ, C-M-A-Q, which stands for Comprehensive Air

1 Quality Model. And the application of that was applied first
2 in the southeast United States, essentially, over the region
3 that was a part of an organization that's called SESARM,
4 S-E-S-A-R-M, Southeast Air Resources Managers.

5 We also did work for industry. We did meteorological
6 modeling for Duke Power. We did training with using new
7 models for TVA.

8 And that's pretty much the bulk of the work that was
9 done during that period.

10 Q. All right. And you testified you were a weather officer
11 with the U.S. Air Force.

12 A. Yes.

13 Q. And that involved meteorological analysis?

14 A. I'm sorry?

15 Q. That involved meteorological analysis?

16 A. Yes.

17 Q. Can you tell us what was involved with your
18 meteorological analysis with the Air Force?

19 A. That sort of work involves collecting weather data from
20 various locations around the country. Back those days, we
21 did not have computerized analysis. We had to do hand
22 analysis of the weather data. We use those data, interpret
23 it, and then use information to make forecasts.

24 Q. And then, with the California Air Resources Board, you
25 were involved in the evaluation and design of air quality

1 models?

2 **A.** Yes, I was. We were in a period of rapid growth in the
3 development of more complex air quality models and we did a
4 considerable amount of work in evaluating them. We developed
5 some guidelines for the evaluation of air quality models,
6 particularly the more complex photochemical models.

7 **Q.** And at the North Carolina Supercomputing Center, you
8 were also involved in the application of air quality models?

9 **A.** Yes, that's correct.

10 **Q.** And that's currently what you do at STI?

11 **A.** Yes.

12 **Q.** Can you summarize how many years of experience you have
13 in air quality analysis and air quality modeling?

14 **A.** I've been involved in air quality and meteorological
15 analysis for almost 35 years, and I've been applying and
16 evaluating meteorological air quality models for over 25
17 years.

18 **Q.** Can you give us a sense of the volume of air quality
19 modeling that you do at STI?

20 **A.** It's hard to keep track these days. We used to keep a
21 score card in the early days. But we've run -- trying to
22 think -- at least hundreds of applications over the last two
23 years.

24 Right now we're running daily model simulations for the
25 entire United States twice a day. So, essentially, we're

1 looking at model output every day, twice a day, and we've
2 been doing that for almost a year now.

3 Q. Now, we've established you've done a lot of air quality
4 modeling, Mr. Wheeler. Can you tell us what's involved in
5 air quality modeling, what it is? Can you explain air
6 quality modeling to us?

7 A. Certainly. Air quality modeling involves taking the
8 known process that's in the atmosphere, both physical and
9 chemical, and putting it into a computer simulation so that
10 we can predict air quality outcomes from meteorology and
11 emissions.

12 **MR. GOODSTEIN:** Your Honor, per our stipulation, I
13 tender Mr. Wheeler as an expert in air quality analysis and
14 modeling.

15 **THE COURT:** Let the record show that the Court so
16 holds.

17 **BY MR. GOODSTEIN:**

18 Q. You're involved in some profession organizations, Mr.
19 Wheeler, in the field of air quality and modeling?

20 A. Yes. I'm a member of the Air and Waste Management
21 Association, American Meteorological Society, National
22 Weather Association, and the American Association for the
23 Advancement of Science.

24 Q. And you're also a certified consulting meteorologist?

25 A. Yes, I am a certified consulting meteorologist, No. 529,

1 by the American Meteorological Society.

2 Q. What does that involve?

3 A. The certified consulting meteorologist program is a
4 program where, by establishing experience, knowledge, and
5 credibility, I would say, ethics, that folks that want to use
6 a meteorologist or an air pollution meteorologist can be
7 assured that their background has been investigated and that
8 they are qualified for the area of expertise in which they
9 stated.

10 Q. And you also participate on the CMAS board. Is that an
11 advisory board to USEPA?

12 A. Yes. USEPA, in 19 -- in the year 2000, established what
13 they call the Community Modeling and Analysis System, CMAS,
14 C-M-A-S. This system was created by EPA to maintain their
15 air quality models, particularly the more complex ones, to
16 distribute it to interested parties, to assure that updates
17 to it have been verified and meet the requirements of
18 quality, and also to provide training.

19 My role has been, since the beginning the CMAS center,
20 to serve on their advisory committee and provide input on the
21 direction of that center.

22 Q. And do you have regular reviews of any developments that
23 might affect the CMAQ model?

24 A. Yes. Being involved in that external advisory committee
25 offers me the opportunity to continually monitor the progress

1 of the models that they are involved with, and providing
2 improvements as well.

3 Q. And did you receive from Dr. Jim Staudt -- did you
4 receive emissions estimates from Dr. Jim Staudt in this case?

5 A. I'm sorry. I didn't quite understand.

6 Q. Did you receive emissions estimates from Dr. Jim Staudt
7 in this case?

8 A. Yes, I did.

9 Q. And did you use those to perform air quality modeling?

10 A. Yes. Dr. Staudt provided us with estimates of a 2013
11 base emissions for TVA coal-fired power plants, as well as a
12 second set of emissions that involve the caps sought by North
13 Carolina.

14 Q. And did you estimate the impacts of emissions from TVA
15 coal-fired power plants on air quality in the region using
16 the emissions estimates provided by Dr. Staudt?

17 A. Yes, I did.

18 Q. And did you estimate the air quality improvements that
19 would result from the additional air pollution controls
20 sought by North Carolina in this case?

21 A. Yes, I did.

22 Q. And can you summarize for us the conclusions that you
23 reached after you did your modeling analysis?

24 A. For the modeling analysis, the main conclusions were
25 that TVA facilities, coal-fired power plants, were having an

1 impact on air quality in North Carolina and throughout the
2 region.

3 The other main conclusion was that the reductions sought
4 by North Carolina would result in substantial air quality
5 benefits, again in North Carolina and throughout the region.

6 Q. And did you prepare -- along with Mr. Chinkin of Sonoma
7 Technologies, did you prepare expert disclosure reports in
8 this case?

9 A. Yes, we prepared three expert reports.

10 Q. And they should be at the back of your binder,
11 Mr. Wheeler, if you can identify them for us. The reports
12 are labeled Plaintiff's Exhibit 464, 465 and 466. Can you
13 identify those as true and correct copies of the expert
14 disclosure reports you've prepared in this case?

15 A. Yes, I can verify these.

16 Q. And can you tell us in a little more detail,
17 Mr. Wheeler, how you analyzed the emission estimates provided
18 by Dr. Staudt and arrived at the conclusions you've just
19 provided to us?

20 A. Well, I should talk a little bit about how these models
21 are used for that sort of assessment.

22 The standard practice for modeling to develop
23 assessments of control strategies or to look at potential
24 benefits of emission controls involves a multistage process.

25 In the first stage, we model a historical episode. In

1 the case we're involved with, we modeled 2002. And the
2 reason we do that is, by modeling a period when we had
3 measurements, we can do evaluation of the model. That
4 evaluation is designed to give us confidence in the
5 predictive ability of the modeling system.

6 We then move to a second phase. Normally, we want to
7 look at the impact in some future year. We then create what
8 we call a future-year base case, and that future year base
9 case includes keeping all of the meteorological inputs of the
10 model the same as in 2002 and only changing the emissions.

11 The normal way to do this is to project the emissions to
12 the future year, considering growth of controls. The
13 controls we normally do in a base case simulation are only
14 those that are on the books, those that are legally
15 enforceable.

16 And then we start -- we would normally do a simulation,
17 say, if we were looking, for example, at a particular level
18 of air quality, what's going to happen in 2013. If we're
19 trying to hit a particular target of air quality, we may not
20 reach that, and in that case, we do additional simulations to
21 evaluate control strategies. Sometimes these are called "on
22 the way." These may be plans that EPA has but hasn't been
23 implemented yet. They may include just some things that
24 agencies or the industry might want to try as controls.

25 And the use of that kind of third set of modeling is to

1 help us assess whether -- what kind of controls would be
2 useful for attaining the particular air quality objective in
3 the analysis.

4 Q. And what pollutants, in particular, did you model for
5 TVA? What pollutants did you model?

6 A. Particular what?

7 Q. What pollutants did you model?

8 I'm sorry. I'm just trying to find the right distance
9 from this microphone. Is that better?

10 A. Yes.

11 Q. What pollutants did you model?

12 A. Something keeps hitting. What did you say?

13 Q. What pollutants did you model?

14 A. I keep getting a pounding sound.

15 Q. What pollutants did you model?

16 A. Which pollutants?

17 Q. Yes. That seems to work better.

18 A. The air quality modeling system that we use, we have the
19 ability to model many pollutants. These include a lot of
20 what we call precursor pollutants. These are pollutants that
21 form pollutants in the atmosphere.

22 The main pollutants that we looked at in this modeling
23 were ozone and particulate matter less than two and a half
24 microns in diameter. We refer to that as PM2.5.

25 But there are actually, literally, dozens and dozens of

1 other pollutants that are actually modeled in the simulation.
2 The modeling tool we used also has the ability to look at
3 deposition of pollutants that are modeled to the ground, as
4 well as calculating visibility from particles in the
5 atmosphere.

6 Q. And what particular model did you use for your work in
7 this case?

8 A. We use the version of the CMAQ that was used by the
9 VISTAS Regional Planning Organization in their modeling of
10 the southeastern United States.

11 Q. And do you have experience with the CMAQ model
12 previously?

13 A. Yes. I've been involved with it, as I mentioned,
14 development of its prototype back in the '90s, have applied
15 it since that time, and this is the model that we are
16 currently running twice a day for the entire country.

17 Q. And is it an accurate model that fairly and accurately
18 predicts impacts of emissions on air quality in a region?

19 A. Yes, it does. This is one of the most advanced models
20 that have been developed. It's a culmination of over 30
21 years of research improvement and application. And the other
22 part of it is that it is one of the only few models that have
23 been rigorously peer reviewed over the course of the last
24 five years.

25 Q. All right. And I want you to just describe briefly for

1 us how it works. And I'll refer your attention to
2 Plaintiff's Exhibit 128 for identification.

3 **A.** CMAQ is what we refer to as a photochemical grid model.
4 The term grid model comes from the fact that it's composed of
5 a bunch of grid cells that are combined together. It's
6 photochemical in that it looks at the interaction of
7 chemicals in the atmosphere with sunlight, thus
8 photochemical, which result in the formation of various
9 pollutants.

10 You can see in this example how we used to apply these
11 models over an urban area. There were lots of problems with
12 doing them in just a particular urban area because there were
13 cities downwind that could contribute.

14 And in the 1990s, the 1994 State Implementation Plans,
15 S-I-P, SIPs. It was found that many of them failed to be
16 successful because the models only included their immediate
17 area and didn't affect -- consider the effects of transport.
18 So the modeling community responded with development of
19 larger scale models covering the, in the case that we're
20 doing, the entire United States, and have applied these
21 models in a similar fashion at various regional planning
22 organizations across the entire United States.

23 **Q.** All right.

24 **A.** And each of these boxes that you see in the model, there
25 are a series of processes that go on in those boxes which

1 represent the physics and chemistry of the atmosphere.
2 Really, the ability to expand these large domains has been
3 the result of improvements in computing technology in recent
4 years, allowing us to add more comprehensive treatment of all
5 the processes.

6 Q. Referring your attention to Plaintiff's Exhibit 127.

7 Should be on the screen in front of you.

8 Sir, can you explain to us how these models work?

9 A. Yes. As I mentioned, the modeling domain is broken up
10 into a number of boxes, and there are processes that are
11 going on that affect air quality. For example, in this, say,
12 one cell out of one of the larger grid models, what we see is
13 there is emission processes, emissions being emitted into the
14 grid cell. There are advection or transport of pollutants in
15 and out of the grid cell; there is solar radiation coming
16 down and interacting with the various admitted pollutants;
17 and there's chemical transformations causing transformation
18 of some species of chemicals through others.

19 We also have processes such as surface deposition, where
20 pollutants are removed from the modeling system down to the
21 surface where there is uptake by plants or soils or humans.

22 Q. All right. So the models simulate how pollutants, once
23 they're released from a source, are going to behave in the
24 atmosphere?

25 A. That's correct.

1 Q. And you mentioned earlier that you modeled ozone PM2.5
2 and nitrate and sulfate deposition in this case.

3 A. That's correct, we did.

4 Q. Can you explain for us why you modeled those particular
5 pollutants?

6 A. Yes. Ozone has been a long-standing problem in the
7 United States, reaching back into the 1940s. It's known to
8 be very reactive. It reacts with metals. It reacts with
9 tires. In fact, some of the early sampling techniques, we'd
10 put a piece of rubber in a bottle with some ozone and you'd
11 count the number of cracks in that to determine the
12 concentrations. We have much more advanced techniques today.

13 But the fact that it is an oxidant, it will enter into
14 lung tissue, for example, and cause inflammation. It also
15 does damage to plant material, causing crops to be reduced.
16 And so that's our main concerns there.

17 For particulate matter --

18 Q. Is ozone pollution contributed to by power plant
19 emissions?

20 A. Yes. Actually, it's contributed to by all combustion
21 sources. The source of ozone comes from oxidized nitrogen.
22 The sunlight breaks down some of the molecules off of the
23 oxides of nitrogen and they form into an ozone molecule in
24 the atmosphere.

25 There are some other processes that are important.

1 Volatile organic compounds, VOCs, also play a role in ozone
2 formation, acting as an accelerant to the formation of ozone.
3 So some of the most important emissions that we're concerned
4 with are VOCs and NOx.

5 We have to remember, though, that NOx is the basic
6 building block for ozone. It provides the oxygen that's
7 broken free and combined to form ozone.

8 Q. So you looked at the effect of nitrogen oxide emissions
9 from TVA power plants on ozone levels in the region using the
10 CMAQ model?

11 A. Yes, we did. In looking at both the two scenarios, one,
12 the base case, and then the control scenario, we can see that
13 by the changes in emissions at TVA's coal-fired power plants
14 of NOx that we get a response to ozone in the region.

15 Q. And what kind of response do you get?

16 A. As we reduce emissions at TVA's power plants, we get
17 reduction in ozone throughout the region.

18 Q. And do those reductions also take place -- do they take
19 place in North Carolina?

20 A. Yes, they do.

21 Q. And Kentucky and Alabama and Tennessee?

22 A. We saw it almost throughout the entire modeling domain.

23 Q. You also testified that you modeled PM2.5, which is fine
24 particles or small particles.

25 A. Yes. The small particles come from many sources. It's

1 much more complex than ozone in terms of the reactions. Some
2 fine particles are emitted directly by combustion sources,
3 with the majority of particulate matter that actually forms
4 in the atmosphere from other gases. The principal sources
5 are sulfur dioxide, which converts to sulfate in the
6 atmosphere, and oxides of nitrogen, which convert to nitrates
7 in the atmosphere.

8 Q. Can you give us a sense of how small these particles
9 are?

10 A. I think we have a figure that indicates it.

11 Q. All right. Like to show you Plaintiff's Exhibit 125 for
12 identification.

13 And this is a figure out of your report, Mr. Wheeler?

14 A. Yes, it is. This is a figure that we obtained from EPA
15 which gives a perspective on these particles.

16 Humans are really designed to filter out particles, or
17 at least larger particles, through their respiratory system.
18 The smaller the particles get -- so hair will be captured
19 high in the respiratory system. Some of the smaller
20 particles, dust and pollen, can work further down. And by
21 the time we get to PM2.5, these particles are small enough to
22 penetrate into the lung, deep into the lung, where they cause
23 some damage.

24 There's also what we call ultrafine particles that are
25 much smaller than the PM2.5 that are included in that range

1 of particles, because PM2.5 is everything less than two and a
2 half microns in diameter; and those very fine particles can
3 penetrate very deep into the lung tissue, even to the point
4 where the tissue is exchanging oxygen from the lung and the
5 blood system. These little, very small particles --

6 **MR. FINE:** Your Honor, I'm going to have to
7 interpose an objection here. I do not believe that
8 Mr. Wheeler was qualified as an expert in the potential
9 health impacts from PM2.5.

10 **MR. GOODSTEIN:** Your Honor, he's been in the air
11 quality analysis field for over 30 years, and part of air
12 quality modeling and air quality analysis is having
13 familiarity with the policies, regulations, limitations on
14 these pollutants and why they are regulated and controlled
15 and need to be controlled.

16 We have other witnesses who are medical doctors and
17 Ph.D.'s in public health who are going to testify in more
18 detail. We're just giving an overview for the Court of how
19 these pollutants, secondary pollutants, are formed and why
20 Mr. Wheeler selected those as the pollutants that he would
21 model the concentrations of based on TVA's emissions and the
22 changes in emissions that North Carolina is seeking in this
23 case.

24 **MR. FINE:** Since Mr. Goodstein has already noted
25 that they're going to have other expert testimony from people

1 who are qualified in the field, I don't see why we're getting
2 into these areas with this witness.

3 **MR. GOODSTEIN:** This is just background, Your
4 Honor. In order to understand the significance of the
5 results of the model, we wanted to at least describe for the
6 Court what pollutants we're modeling and why we're interested
7 in measuring or estimating those concentrations and the
8 reductions in the concentrations that result throughout the
9 region with the additional controls on TVA's plants.

10 So we're just moving it right along, Your Honor.

11 **THE COURT:** I'll overrule the objection at this
12 time.

13 **MR. FINE:** Very well, Your Honor.

14 **BY MR. GOODSTEIN:**

15 **Q.** Mr. Wheeler, were you finished explaining why you
16 selected PM2.5 as a pollutant to model in this case?

17 **A.** Yes. I have just one more point, and that was, in the
18 ultrafine particles, they can actually penetrate into the
19 bloodstream and have health effects associated with those.
20 We have to be aware of these because -- to understand which
21 particles and which levels, sizes that we need to be
22 modeling.

23 **Q.** So you looked at ozone; you looked at PM2.5.

24 Can you explain the difference for us between a primary
25 pollutant and a secondary pollutant?

1 **A.** Primary pollutants are those compounds or chemicals that
2 are emitted directly from an emission source. Those would be
3 like NO_x and SO₂. And, yes, SO₂ is a pollutant that has a
4 standard. At very high concentrations, it can be unhealthy
5 as well.

6 But a large portion of the things that we're looking at
7 in terms of fine particulate matter and ozone actually form
8 in the atmosphere from some of those primary pollutants. And
9 that's what we do with these models, is perform the chemistry
10 of those to actually produce the secondary compounds and
11 particles.

12 **Q.** So ozone itself and PM2.5 itself are not emitted from
13 the power plants?

14 **A.** There is a small fraction of PM2.5 that is emitted
15 directly from power plants, but more than 90 percent of the
16 particulate matter that we observe in the atmosphere forms in
17 the atmosphere rather than being directly emitted.

18 **Q.** So it forms based on the chemistry and the transport
19 that's taking place in the atmosphere after these pollutants
20 are emitted?

21 **A.** That's correct.

22 **Q.** And are all fine particles chemically identical?

23 **A.** No. One of the things about particulate matter is that
24 it is a composite of different types of particles. In
25 general, we tend to classify those into sulfates, nitrates,

1 carbon and soils. These are general categories. These are
2 even subdivided further by scientists. But those are the
3 major ones.

4 Q. And how important are the sulfate and nitrate components
5 of PM2.5 in the southeast region?

6 A. Very -- the sulfate is very important. When we look
7 across the country, the particulate matter in the Southeast,
8 actually, throughout the eastern United States, is dominated
9 by sulfate. As we move into the west, it's more involved
10 with soils and nitrate. So this is very important,
11 controlling for the sulfate in the eastern United States.

12 Q. And what's the major source of sulfate in the
13 southeastern United States?

14 A. Generally, it's considered coal-fired power plants.
15 Many of the other sources of SO₂ and sulfate have been
16 regulated over the years. There still are some industrial
17 processes, but majority is from coal-fired power plants.

18 Q. So we talked about ozone; we talked about fine
19 particles. You also mentioned that you modeled sulfate and
20 nitrate deposition.

21 A. Yes.

22 Q. And looked at the impacts of TVA emissions on those
23 pollutants and the improvement that would result from the
24 reduction in emissions from TVA's power plants.

25 MR. FINE: Your Honor, at this point, I'm mindful

1 of your earlier ruling in terms of the question about sulfate
2 deposition, but for purposes of the record, I need to
3 interpose an objection again to any testimony from this
4 witness as to sulfate deposition.

5 **MR. GOODSTEIN:** I think this has already been ruled
6 on, Your Honor.

7 **THE COURT:** All right. The objection is overruled.

8 **MR. GOODSTEIN:** Thank you.

9 **BY MR. GOODSTEIN:**

10 **Q.** Please go ahead, Mr. Wheeler, and explain what modeling
11 you did for sulfate and nitrate deposition.

12 **A.** Yes. As I mentioned, in terms of processes that are
13 dealt with in these photochemical grid models, one of them is
14 deposition of both the particles and gas to the surface. The
15 modeling system, CMAQ, automatically keeps track of the
16 deposition of the various species, both wet and dry
17 deposition. And so as we perform these simulations, we can
18 compare the sulfate and nitrate deposition that occurred
19 between the base case and the control simulation.

20 **Q.** And what is sulfate and nitrate deposition? How is that
21 commonly referred to and what does it do?

22 **A.** Well, in general, when the -- in the popular press, they
23 think about this as acid rain. What happens is, wet
24 deposition, particularly of sulphates, will dissolve in water
25 droplets and deposit out to the surface. When they dissolve

1 into the water, they form sulfuric acid, and that sulfuric
2 acid is deposited to surfaces, soil surfaces, water bodies.

3 Q. So it's commonly referred to as acid rain?

4 Commonly referred to as acid rain, as in deposition?

5 A. I'm sorry?

6 Q. Is it commonly referred to as acid rain?

7 A. Yes. That's what I was saying. Acid deposition or acid
8 rain.

9 Q. So you used the VISTAS version of CMAQ to model each of
10 these pollutants?

11 A. Yes, I did.

12 Q. And what is another air quality parameter that you
13 modeled?

14 A. One of the parameters that are modeled are based on
15 particulate matter, and that's visibility. Modeling actually
16 does a calculation of visibility based on the distribution,
17 size distribution, of particles predicted by the model.

18 Q. And you mentioned that you used the VISTAS version of
19 CMAQ to perform the modeling that you did in this case?

20 A. Yes.

21 Q. Can you tell us what that means?

22 A. What that means?

23 Q. Yes. Who is VISTAS, and why did you select that
24 particular version of the CMAQ model?

25 A. VISTAS is the regional planning organization for the

1 southeastern states. The regional planning organizations
2 were established by the USEPA after the results of some of
3 the ozone transport assessment modeling, when they realized,
4 to address regional problems of air quality, and particularly
5 regional haze, they would have to have coordinated efforts,
6 not a single state-by-state effort.

7 And so there were five regional planning organizations
8 that were established. VISTAS is one of those. It stands
9 for Visibility Improvement State and Tribal Association of
10 the Southeast.

11 Q. Okay. And do you have a figure in your report which
12 shows the regional planning?

13 A. Yes, I do.

14 Q. Can we put up Plaintiff's Exhibit 129?

15 A. Yes. These are the five regional planning
16 organizations.

17 Q. Okay. And can you show the VISTAS region for us?

18 A. Yes, the VISTAS region is here in blue. The region
19 itself involves a set number of states in that area for
20 regional planning. However, the modeling domains that they
21 use are much larger. In fact, the modeling domain that
22 VISTAS developed covers the MANEVU, the midwest RPO, and
23 CENRAP, C-E-N-R-A-P, domains.

24 Q. Do you know what TVA's involvement in VISTAS was?

25 A. The TVA's involvement with this modeling?

1 **Q.** Yes.

2 **A.** Yes. They were one of the stakeholders involved in
3 providing input to the entire process. They provided
4 emission inventories. They provided suggestions on model
5 performance and were actively -- they were active
6 participants in the modeling.

7 **Q.** Were the contractors involved in this case on behalf of
8 TVA involved in VISTAS and the CMAQ modeling for VISTAS?

9 **A.** Yes. Alpine Geophysics was one of the contractors.
10 There was some contractor to Environ Environmental,
11 E-n-v-i-r-o-n.

12 **Q.** And so they were involved in the selection and running
13 of the CMAQ model for purposes of the VISTAS program?

14 **A.** I'm not completely certain of their individual roles,
15 but they were obviously involved in part of the modeling. It
16 included -- I know they were highly involved in developing
17 emission inventories for VISTAS, and they had the opportunity
18 to review the modeling protocols, the model performance
19 evaluation, and the actual modeling done by VISTAS.

20 **Q.** So TVA and Alpine Geophysics, which is Dr. Tom Tesche's
21 firm, who is a modeling witness for TVA in this case, were
22 both involved in the VISTAS program.

23 **A.** Yes.

24 **Q.** And they were involved in the modeling, using CMAQ, of
25 various scenarios for the VISTAS program in the southeast

1 region.

2 A. Yes. They were involved in both CMAQ and CAMX modeling.

3 Q. What was the purpose of that modeling after VISTAS?

4 A. The modeling was developed for VISTAS to develop a
5 checkpoint in 2018 towards the goal of reaching actual
6 background conditions by 2060, and they performed simulations
7 in 2009 and 2018, looking at control scenarios that included
8 "just on the books," as well as "on the way," and some other
9 additional scenarios, for achieving those goals.

10 Q. So the purpose that VISTAS was accomplishing by running
11 the CMAQ model was the study of regional air quality changes
12 resulting from emissions changes from stationary sources in
13 the region?

14 A. Projected emission changes, yes. They're particularly
15 focusing on particulate matter and visibility.

16 However, many of the states that have been involved in
17 the VISTAS modeling have created another organization called
18 ASIP, Association of Southeast Integrated Planning, and many
19 of these states are using it for other purposes, such as
20 ozone state implementation plans and particulate matter in
21 state implementation plans, or SIPs.

22 Q. And what is the purpose that you used the CMAQ model
23 here in this case on behalf of North Carolina?

24 A. Yes.

25 Q. Similar type of purpose to VISTAS?

1 **A.** Yes.

2 **Q.** Can you describe that for us?

3 **A.** The work that we...

4 **Q.** Yeah. How does your use of the CMAQ model in this case
5 compare to the use of the CMAQ model by VISTAS?

6 **A.** Well, we essentially used it in an identical fashion
7 except for the emissions control scenarios and the base case
8 for 2013. Where they were looking at 2009 and 2018, we were
9 using it for the 2013 year.

10 **Q.** And did you, in fact, receive files, computer files
11 containing the VISTAS version of CMAQ from VISTAS?

12 **A.** Yes. We had made a request for their entire modeling
13 system. They provided us with their 2002 base case, their
14 2009 base case, and 2018. They provided us the model code
15 and the model outputs as well.

16 **Q.** All right. And referring to Exhibits 131 and 132 in
17 your book, Plaintiff's Exhibits 131 and 132 -- I'm sorry --
18 130 and 131 -- are these summaries of the computer files that
19 you received from the VISTAS organization which contained the
20 VISTAS version of CMAQ that you ran in this case?

21 **A.** Yes. These are the logs that we prepared as we received
22 hard drives from VISTAS. It indicates a general summary of
23 the contents, who they were received from, and the number of
24 files and the overall size. You can see there were over
25 33,000 files making up almost 1.8 terabytes of data.

1 Q. And were some of those files containing the VISTAS
2 version of CMAQ actually sent to you from Alpine Geophysics
3 themselves, Dr. Tesche's firm?

4 A. Yes. Actually, the second disk drive came directly from
5 Alpine Geophysics. After we inventoried these drives, which
6 I think you mentioned them, Exhibit 131, we went through and
7 analyzed all the files. We found that there were some
8 missing, and so we made a secondary request, and those were
9 provided directly by Alpine Geophysics.

10 Q. Did the VISTAS program also confirm the performance, the
11 acceptable performance of the VISTAS version of CMAQ?

12 A. Yes, they did. They found it sufficiently accurate and
13 precise to proceed with control strategy modeling.

14 Q. And did you review the work that was done by the VISTAS
15 program to confirm the accuracy and the precision of this
16 VISTAS version of CMAQ?

17 A. Yes. They had published several reports and slide
18 presentations discussing model performance. I reviewed those
19 reports. There had been some earlier problems with the model
20 in terms of organic aerosols, but they came up with an
21 improvement or expansion to the model, making it more
22 comprehensive, and solved that problem.

23 Some of the earlier reports that they issued still
24 indicated that problem, but we were able to verify on our own
25 accord by looking at thousands of products that they

1 developed for model evaluation that the model was performing
2 sufficiently.

3 Q. And did you review, among other things, what's called a
4 bugle plot, to confirm the precision and accuracy of the CMAQ
5 model that was viewed by VISTAS?

6 A. Yes. The bugle plot is just one of the analyses that
7 were performed. I think I have that in my expert report.

8 Q. Can I show you Plaintiff's Exhibit 132 for
9 identification?

10 And can you explain to us what this shows, this exemplar
11 of the type of work that VISTAS did to verify the precision
12 of the CMAQ model?

13 A. Yes. As I said, this is just one of the many graphical
14 evaluations. This one was for sulfate over the entire year
15 2000. What it shows is the fractional bias. This is
16 basically whether it's under-predicting or over-predicting on
17 the annual averages from a number of monitoring networks that
18 measured particulate matter, including sulfate.

19 And what you see on this plot is there are two blue
20 lines in the center, which it says they are goals. This is
21 what we're aiming at to be able to use this model for control
22 strategy evaluation.

23 On the outer bounds, they've put what they call
24 criteria. Their idea is that if you don't quite make the
25 goals, you should -- but you're within that criteria, that

1 you should use it with caution, and if it's outside that
2 outer range, it shouldn't be used at all, or you need to go
3 back to the drawing board.

4 The bugle part of it is a recognition that a very low
5 concentration, a very small difference between a model
6 prediction and a monitor can increase very rapidly in terms
7 of percent, so if you talk about, you know, a tenth of a
8 micron when you only have two tenths of a micron
9 concentration, that would be unusual.

10 But what we see here is none of the data that they
11 collected was below 2 micrograms per cubic meter in
12 concentration.

13 I want to point out one thing, though, about this that's
14 really important. When we think about model performance
15 evaluation, we need to understand that model predictions and
16 measurements are not the same. There are uncertainties in
17 measurements. There may be calibration errors. There may be
18 the fact that it's got an exposure to a local source. It's a
19 point measurement where models are grid averages over, in our
20 case, a 12-kilometer area, and so we can't expect the models
21 to predict at a point here on the desktop, which a
22 measurement actually is.

23 So we have to get within this kind of range of operation
24 to gain that confidence, but we shouldn't think of the
25 uncertainty in the model as the difference between the

1 measurement and the model value because they are different
2 things.

3 Q. Okay. So one of the things you do to confirm model
4 performance is look at how the results from the setup runs
5 and the verification runs compared to actual monitored
6 concentrations throughout the domain?

7 A. That's correct.

8 Q. And so is there going to be some variability between the
9 way that even an acceptably performing model and the actual
10 measure values compare?

11 A. There has to be because they're not measuring -- they're
12 not the same thing.

13 Q. So you're using, for a model performance run for these
14 models, a base year?

15 A. Yes.

16 Q. A base year of meteorology?

17 A. Yes.

18 Q. As well as emissions?

19 A. Correct.

20 Q. And what was the base year that was used in the VISTAS
21 confirmation of the CMAQ model?

22 A. VISTAS chose the year 2002 for many reasons. They did
23 some analysis of previous air quality. They also looked at
24 what the other regional planning organizations were doing,
25 because the idea behind the RPOs was to, if possible, have a

1 coordinated effort so that, when they were doing modeling,
2 they could exchange information between the various regions.

3 Q. And did you do some confirmation to verify that the base
4 year 2002 meteorology was an appropriate base year to use for
5 the simulations you did in this case?

6 A. Yes. We did a standard analysis that we often do to
7 take a look at air quality and how meteorology might affect
8 that. We prepared a couple of figures and put those in our
9 report. They basically show ozone and particulate matter
10 over a range of seven years.

11 Q. Okay. I want to refer you first to Plaintiff's
12 Exhibit --

13 THE COURT: Let's take our noon recess and we'll
14 come back to that.

15 MR. GOODSTEIN: Thank you, Your Honor.

16 THE COURT: 2:15, Marshal.

17 (Lunch recess.)

18 *****

19 [END OF VOLUME 3A]

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UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF NORTH CAROLINA
CERTIFICATE OF REPORTER

I certify that the foregoing transcript is a
true and correct transcript from the record of proceedings
in the above-entitled matter.

Dated this 17th day of July, 2008.

S/ Karen H. Miller

Karen H. Miller, RMR-CRR
Official Court Reporter